THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE APOTHEOSIS OF ELECTRICITY.

WE touched briefly last week upon the nature of the presidential address of Mr. S. Z. de Ferranti; we are now able to print it in full, and we have followed this unusual course because we believe that not only the members of the Institution of Electrical Engineers, but every person engaged in or connected with the electrical industries ought to be made acquainted with its contents.

We do not suggest that there is the slightest prospect of the immediate or even early realisation of the prophetic dream of the President; at present, unfortunately, we are still passing through a period of low prices, and we fear that many of our manufacturing friends will receive his prognostications with a wry smile. But we have faith in the future; and who that keeps himself acquainted with the rapid progress of the age, the numerous processes to which electricity is being applied, the new outlets that are constantly being found for electrical apparatus, and the incessant improvements in the means for generating and distributing electricity, can possibly doubt that in the long run the goddess Electra must reign supreme?

Looking backward 50 years, the President commented on the marvellous inventions that had been developed; who can doubt that other, perhaps even more wonderful, discoveries will be made by the army of investigators that is continually at work, probing into the hidden mysteries of Nature?

The examples cited by Mr. Ferranti might, perhaps, have been more happily selected, for neither can be said to have as yet attained the full measure of success that we all hope to see achieved: but the vast strides made in the reduction of cost and improved efficiency of steam, gas and hydraulic prime movers, of electrical generators and transforming apparatus, the high pressures (over 100,000 volts) that have been proved practicable for electrical transmission, the extremely high efficiency of electric lighting apparatus, the development of heavy electric traction, the universal adoption of electric power which is in progress—all of which are the product of the past 30 years, and many of them the last 10 or 20 years—amply suffice for the purpose of demonstrating that the revolution which he forecasts is already taking place and far advanced.

We believe that the more carefully the President's address is studied and pondered over, the more intense will become the conviction that his enthusiastic optimism is based on sound foundations, and that eventually Electra must triumphantly prevail.

It will be seen that a vast amount of work remains to be done before the dream can become a reality. Where, for instance, is the heat engine of 25 per cent. efficiency that he requires? The system that will extract the utmost from the coal both in heat energy and in by-products? The improved electric smelting process? Perhaps they are not

so far away as may be thought; indeed, the President himself gives a clue to the first, and if the chemist and metallurgist improve their processes as quickly as the engineer his plant, we may not have to wait very long before we see.

On the other hand, great changes must be brought about in social, economic and legislative conditions before the dream can be accomplished to the full. Intensive agriculture, the redistribution of labour, and the conversion of the local authorities from petty parochial views to recognition of the true interests of the nation, are indispensable accompaniments of the progress called for in technology; and in this ancient country vested interests are certain to be met at every turn, while the Socialistic tendencies of the times, if they go unchecked, may strangle individualism, and therefore progress at its source.

What is the moral?—Educate! Open the eyes of the people; let them see what has been, and shall be, accomplished by electricity. Let us no longer hide our light under the bushel of ignorance, but go forth and awaken public interest, through the medium of the daily Press, and by lectures and demonstrations. No science excels that of electricity in its wealth of resources, its variety of beautiful phenomena, its never-failing interest. An immense amount of good work could be done by means of popular lectures, at trifling cost. Broader views, such as the President has so ably set before us, must be encouraged and instilled. Mr. Ferranti has led the way before; he leads again, and we confidently accept his guidance; we must all look ahead—and go ahead.

Commercial Engineering.

We have read with great interest the inaugural address of Mr. M. J. Railing, chairman of the Birmingham Local Section of the I.E.E., partly for the reason that its conclusions re in the main identical with the views that we have so often expressed. After reviewing the past and present of the industry, Mr. Railing declares that its salvation lies in the production of men endowed with the knowledge and ability to sell the wares that we manufacture. Our workshops, our factory organisation, our designers and our workmen are all that could be desired; the only essential that is lacking is a constant and abundant flow of work through the shops, to keep the manufacturing costs down to the minimum, and enable us to beat our rivals in quality and price. These are hard facts which cannot be denied. The markets of the world are open to us, says Mr. Railing; we can provide for their electrical needs. We only want the men who can bring those markets and our workshops together—and *voilà!* The thing is done.

We must have "a generation of commercial engineers, or engineer traders," who shall be armed with all those qualities which make for efficiency in salesmanship—sound technical knowledge, familiarity with foreign languages, a full training in commercial methods, tact and enterprise. Here are sufficient requirements to constitute a new profession, upon which a man must embark at an early age—the Chairman will have no half-measures. University facilities should be provided for the commercial engineer. Undoubtedly we want him, as we have often pointed out; and when we get him we shall have to pay him well—as we have also pointed out. No half-measures!

Next Year's Electrical Exhibition.

Only a few weeks have elapsed since the organising managers of the Olympia Electrical Exhibition issued their prospectuses, yet we understand that there has already been a response so satisfactory as to justify expectations of the event being a complete success. This is no more than we have anticipated all along, for the exhibitions in 1905 and 1908, at Olympia and Manchester respectively, have left a lasting impression upon the minds of all who had anything to do with them; so that the question of whether to exhibit or not, when a really representative opportunity again comes along, only requires to be asked to answer itself. We shall be surprised if next year's exhibition is not the finest thing of the kind that we have ever done. We cannot go the full length of Mr. Ferranti's "all-electric" idea for a year or two, but we can go nearer to it than we have yet reached if we profit to the full from the opportunity that the Olympia Exhibition will afford us of educating the public in an Electrical Fairyland, transacting business in an Electrical Market, and demonstrating industrial applications in an Electrical Workshop.

We understand that plans for the gallery at Olympia—where, it is hoped, very attractive displays of accessories will predominate—will be ready for circulation in the course of two or three weeks. As to the ground-floor of the Hall, nearly two-thirds of the space has been taken, but there are still desirable positions open in the remaining one-third, and firms having heavy electrical and other machinery that they wish to exhibit will be wise if they get into communication with the organising managers straight away. We hope that manufacturers in every class will be co-operating this time. Let the entire electrical industry and trade line-up in full force!

The Law of Distress.

The case of Eungblut *v.* Martin, which was heard in the Court of Appeal on October 28th, decided a point which may be usefully noted by those who hire out electrical machinery. In former times the goods of a person who had let them on hire might be seized under a distress for rent. The law in this regard was altered by an Act passed in 1908, which provided that "if any superior landlord shall levy, or authorise to be levied, a distress on any furniture, goods, or chattels of" any under tenant, lodger, or "any other person whatsoever not being a tenant of the premises or of any part thereof, and not having any beneficial interest in any tenancy of the premises or of any part thereof, for arrears of rent due to such superior landlord by his immediate tenant, such under tenant, lodger, or other person aforesaid may serve such superior landlord or the bailiff or other agent employed by him to levy such distress with a declaration in writing made by such under tenant, lodger, or other person aforesaid, setting forth that such immediate tenant has no right of property or beneficial interest in the furniture, goods or chattels so distrained or threatened to be distrained upon, and that" they are "the property . . . of such under tenant, lodger, or other person aforesaid . . . and to such declaration shall be annexed a correct inventory subscribed by the under tenant, lodger, or other person aforesaid of the furniture, goods, and chattels referred to in the declaration."

In the case in question, the plaintiffs had let a piano under a hire-purchase agreement to a Mrs. Martin. Her husband's landlord, on putting in a distress for rent, seized the piano; whereupon the plaintiffs signed a declaration. This was alleged to be defective on the ground that it was not signed by all the members of the plaintiff firm, and because it was not in the form of a statutory declaration. These were the points adduced by the defendant—the landlord's bailiff who was sued "in trespass" by the owners of the piano. He also objected that as the piano was the subject of a hire-purchase agreement it could be seized. He failed on all grounds. The declaration need not be signed by all the partners in the firm who own the article, and it

need not be made in the statutory form. It is obvious that, however unpleasant it may be for the landlords, this decision is likely to be advantageous to those who let out machinery on hire. If they can only find out in sufficient time that a distress is in progress, they can sail in and release their property from the clutches of the landlord without any very troublesome formalities.

Installation Monopoly in Germany.

The question of the establishment of monopolies in the German electrical industry in connection with the construction of the so-called "overland" central stations, which are merely works for affording a supply to numerous localities whether large or small, has been previously referred to in this journal, and is now again mentioned in consequence of a noteworthy order which has been issued by the Prussian Minister for Commerce and Agriculture to the district governors and the police governor in Berlin. Apart from other interests which have protested against the creation of monopolies, the Union of Electrical Installation Firms and the Association of Electrical Speciality Works have pointed out that in the contracts for the supply of current from the overland stations, the exclusive right of installation is frequently guaranteed either to the central station or to firms definitely favoured; and the supply of all materials for the installations, even including motors, is also frequently reserved to the same sources. Open competition is declared to be rendered further impossible by installation firms being placed under the contractual obligation, before being permitted to compete, to obtain their materials from the station or specified firms, and other difficulties are also met with which keep outside rivalry at a distance. The Prussian Minister points out in this connection that the central stations have a justified interest in the reliable execution of the conductors, switches, and safety appliances, and that therefore only well-trained and experienced contractors and technically approved materials should be admitted, but this by no means justifies a monopoly of installations and materials. The State, the order submits, also has a great interest in seeing that productive classes in the artisan and middle classes are not rendered powerless in face of a monopoly, and in the interest of free competition the duty of the authorities is to refuse to sanction such contracts. It is not easy to understand how the district governors can interfere with the monopolistic tendency which appears to have grown up in Germany in respect of the overland stations already in existence or in process of establishment; new schemes of the kind are now comparatively few, and leave little scope for Government action in the future, even if such action could be effective under the circumstances.

Small Lighting Plants for Canada. — American Consul-General John E. Jones, Winnipeg, Manitoba, reports:—"Attention is directed to the opportunities offered by Western Canada as a market for gasolene and acetylene lighting plants. With the rapid population of the west and the almost daily incorporation of new cities, the question of lighting becomes a most important one from every view-point. There are some cities in Saskatchewan and Alberta where natural gas exists; and many of the towns of greater importance have electric lighting plants operated by either water-power or steam. The great coal beds of Western Canada furnish a fair steam-producing fuel at a minimum cost, which renders the production of electricity comparatively cheap. But there are hundreds of towns far removed from the coal beds which have no water supply to depend upon, and thus require artificial lighting plants. Many of the cities that are provided with plants for electric lighting and motive power are operated by the municipality, and, as is the case with all new enterprises, development and extension are slow. The outlying sections of these must wait, in some instances several years, before they can get the advantages of lighting. It is such that offer to-day a market for gasolene and acetylene plants. Even in the cities of greater size, where electric lighting and even gas lighting is largely developed, there are outlying sections that are continually petitioning for light. In the city of Winnipeg there is to-day an urgent need for a gasolene or acetylene plant in one of the new suburbs; and I believe a manufacturer with a practical lighting system could immediately install such a one." Here is an opening for a small oil-engine or windmill lighting plants.

ELECTRICAL ENGINEERING IN SOUTH ONTARIO.

By G. F. SILLS, A.M.I.E.E.

A few random remarks on electrical engineering in South Ontario may be of interest.

Practically every town, large and small, has its plant, which in some cases is very antiquated. The practice is to generate at 2,200 volts, and the power is transmitted through the streets on poles and stepped down by service transformers, also placed on these poles where necessary. Wires are run into houses overhead at any angle. In a great number of cases, water power drives the plant during the day, and is augmented in the evening by steam plant. The latter is very expensive to run, due to the scarcity of coal, which averages $3½ or $4 per Canadian ton of 2,000 lb. Most of the engines are of the horizontal type.

The only plant of great interest is the Hydro-Electric Power Commission's undertaking. For this purpose power is bought in bulk from the Ontario Power Co. at Niagara Falls, and at present 25,000 H.P. is contracted for, at $9.40 per H.P. per annum, which is reduced to $9 per H.P. above 25,000 H.P.

The Ontario Power Co.'s power house is situated on the Canadian side and just at the foot of Horse-Shoe Falls, the intake being 1¼ miles above the Falls. The water is led in two 18-ft. reinforced concrete pipes to the water-wheels. Power is generated by horizontal generators at 12,000 volts, three-phase, 25 cycles, and conveyed through Siemens Bros.' lead-cased, three-core cables to the main transformer station about half a mile away from the Falls. It is here transformed to 110,000 volts, and distributed to various points in South Ontario, such as Berlin, Guelph, London, St. Thomas, Dundas, &c. At the places named, sub-stations transform down to 13,200 volts, and distribute to a station belonging to the corporation of each town, the old stations being utilised in practically all cases. At these stations the power is again transformed, to 2,200 volts, and distributed as mentioned above.

The transmission line from the main transformer station at Niagara Falls consists of bare aluminium stranded conductors carried on steel towers 65½ ft. high. The insulators used are of the suspended type, eight in series, each complete insulator being about 4 ft. 6 in. long. A portion of the line, viz., 96 miles, has been tested to 170,000 volts successfully.

The writer would like to make special mention of the 110,000-volt oil switches used on this scheme. Each phase is in a separate tank, which stands about 6 ft. high and is oval in shape. Each switch has a double break of 2 ft. each, that is, 4 ft. total break. The special insulators come out at an angle from the top. The distance between phases in the stations is 6 to 7 ft., and no partitions are provided between any 110,000-volt conductors.

The lightning arresters, which of course play an important part, are mostly of the horn type with aluminium core tray, which offers a direct path to earth for lightning instead of always having a damping resistance in circuit, as advocated by large firms in Europe.

The frequency of the new scheme is 25 cycles, although the standard out here is 60. Some of the older plants have 133 cycles.

Street lighting is mostly carried out by either series arc lamps or series tungsten lamps, both being used in conjunction with constant-current transformers. It cannot be said that the streets are over-lighted. Several of the smaller towns in South Ontario have an electric railway service between them, which enables one to visit two or three towns in one day; this is impossible if the railroad is used, as the service is very limited, although in some cases both the Grand Trunk and Canadian Pacific railroads run through the same place. Most towns have their own electric street-car service, a universal fare of 5 cents being charged.

In the main streets of Toronto and London it is proposed to do away with the overhead distribution. In some parts of Toronto the congestion of overhead wires is very unsightly.

As a voltage, 2,200 is considered quite low—that is, of course, as long as one does not come in contact with it.

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It is not usual to protect any switchgear at 2,200 volts in the stations. In one station visited, which is fairly modern, 2,200-volt air-break knife switches are placed on the front of the board with partitions between the poles. Even 13,200 volts is not considered high.

The main hydro-electric power houses at Niagara are magnificent buildings, especially the Electric Development Co.'s station, which is of beautiful exterior design. The entrance hall is of marble. The public are allowed to visit the power houses on payment of a small sum. The main step-up transformers are placed in separate buildings on the hillside. The station mentioned above at present feeds Toronto at 60,000 volts by a double line 85 miles long. The main 60,000-volt terminal station in North Toronto is well worth a visit, the average load at present being 24,000 KW.

At present, the Canadian General Electric, the Canadian Westinghouse, and Allis-Chalmers (Bullock), with works at Peterboro, Ontario, Hamilton, Ontario, and Montreal, Quebec, respectively, have been having matters pretty well their own way; they do not look upon the English manufacturers with a friendly eye, and use baseless arguments for belittling the machines from across the water.

Competition is fairly keen, but not so bad as in England. As far as one can judge, the "Old Country," as England is called, need not fear comparison with any Canadian or American, as regards ordinary generating machinery, as, undoubtedly, the imported plant is of sounder construction and better finish. Where the firms over here lead is, of course, in extra-high-tension transmission schemes, large transformers, usually single-phase, and large vertical 12,000-volt, 12,500-H.P. generators for water turbine drive.

Water is being harnessed all over the country, and undoubtedly there will be a large electrical development.

Siemens Bros. Dynamo Works and the Lancashire Dynamo Co. are, at present, the only English electrical firms who have their own branch offices here. The head office for Canada for the former company is situated in Toronto, and there is a fairly large staff. Other British firms, as Messrs. Dick, Kerr & Co., Bruce Peebles & Co., &c., are represented by agents.

It may be of interest to know that Siemens Bros. Dynamo Works are carrying out the complete equipment of the Port Arthur sub-station, North Ontario, of 2,250 KW. capacity, 22,000 volts. The transformers, four in number, one being a spare, are each of 750 KW., and of the single-phase oil and water-cooled type. The switchgear consists of two incoming 22,000-volt line panels, two transformer panels, and six feeder panels. The switches are arranged for remote control. The necessary lightning protectors of the horn type, with resistances, are also provided. The station will be extended later by another bank of transformers. Erection in Canada, especially out West, is an expensive matter, and men are hard to get.

If reciprocity with the U.S.A. comes about in any form, it will be a great blow to the English firms at present out here.

A PHOTO-ELECTRIC BURGLARY AND FIRE ALARM.

By Dr. ALFRED GRADENWITZ.

A French inventor, M. E. Dafan, at Jonzac, has recently designed a novel burglary alarm, which is operated even before the slightest injury has been inflicted upon the safe or other receptacle. It is, in fact, actuated by the faint light from a dark lantern, or even a match. The apparatus is based on the well-known photo-electric properties of selenium, which, while being in the ordinary condition a perfect insulator, becomes under the influence of light more or less conducting.

The installation consists of a transmitter and a receiver, situated at any distance from one another and connected by an electrical conductor. The transmitter, which is placed in the room to be protected, is a small cylindrical box 4 in. in diameter and less than 1 in. in thickness, containing a strip of selenium wound up in a coil and covered during the daytime by a lid. If there are several rooms to be protected, any number of transmitters, communicating with the same receiver, can be installed. On account of their small volume they are readily placed in a concealed position, though this is not at all essential.

The receiver, installed in the bedroom of the housekeeper or the owner of the house, is a wooden box containing an electromagnetic relay for actuating the alarm. This is generally designed for producing reliable contact with 1 millivolt, and works at any pressure up to about 2 volts. A single sal-ammoniac cell is generally used.

The electromagnetic relay is designed as follows:—In the field of a substantial horseshoe magnet is suspended, by a fine wire about 30 cm. in length, a very light rectangular aluminium frame, on which is wound a galvanometer wire about ·02 mm. in thickness. This frame, only about 30 grammes in weight, has an electrical resistance of about 5,000 ohms. After entering the coil by way of the suspension, the current issues through a point dipping into mercury. The circuit is closed through the transmitter and a battery.

Under the action of the current the suspended coil is deflected, twisting the suspension wire through about 90°. By means of a torsion head the frame can again be adjusted parallel to the magnetic field, after which a horizontal arm with a platinum tip is inserted at right angles to the magnet between the points of two screws. A distance of 5 to 10 mm. between these points is the most advantageous.

As long as the selenium cell of the transmitter is covered by the lid, it maintains its high resistance, allowing only a very small current to pass, and keeping the galvanometer at rest. As soon, however, as, the lid having been removed, the selenium is struck by ever so faint an illumination, the alteration in current intensity will cause the coil frame to move and to make contact with one of the screws, thus closing the local circuit of a bell fixed on the wall of the box.

If the continuous current keeping the suspension wire twisted be weakened or interrupted by the failure of the battery or by cutting the conductor, this wire will unwind of its own accord, causing the platinum tip to strike the other screw, thus actuating the alarm bell and informing the housekeeper of the breakdown.

The alarm bell is actuated through the intermediary of a highly sensitive relay, throwing into its circuit the current of several cells. This relay is of the type used in telephony, and allows the bell to be stopped by lifting a shutter. A hand-operated switch enables the apparatus to be cut out during the day-time.

The conductor connecting the transmitter (or transmitters) with the receiver can be so arranged as to comprise in series connection all the doors, drawers, locks, &c., to be protected. Should any one of these be left open, the circuit will be broken, thus preventing the alarm circuit from being established without actuating the bell.

After being once started, the bell cannot be stopped by any means from the transmitter room, not even by cutting the conductors. The alarm apparatus is thus inviolable and cannot be put out of commission by the burglar.

The same apparatus can be utilised as a fire alarm for signalling an incipient fire. If each of the rooms to be protected be provided with a selenium transmitter, the faint illumination produced, even by the smallest fire, will cause the receiver to ring, so that the conflagration may be detected in time to be nipped in the bud. The sensitiveness of the apparatus can be controlled by adjusting the distance between the screws, varying the length of the suspension wire, or regulating the electromotive force of the battery. In a slightly modified form the apparatus can be designed for working in daylight in the same manner as ordinary electrical alarms.

Crusade Against Tuberculosis.—We wish to keep our readers in mind of this movement, which affects every one of them more or less directly. The Special Appeal Committee will be glad to receive subscriptions, even the smallest, at 20, Hanover Square, W.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Municipal Wiring.

I have been very much interested in the discussion for and against municipal wiring, that has been going on in your columns for the past few weeks. I have been waiting for an abler pen than mine to take up the subject from the wireman's point of view, but as none has come forward, I venture to step into the breach.

Upon the legal aspect of the case I will not dwell; I must say that it seems rather hard for a man to pay rates to help drive himself out of business, but in the main I think it is chiefly the contractors' own fault. As Mr. Bostel says, the contractor never looks at the matter from either the supply companies' or the consumers' side, and he certainly does not canvass as he ought.

All things being equal, we would as soon work for a contractor as a municipality, but then things are not equal. Municipalities are subject to the vote of the electors, and that being so, the work is not only generally well done, but almost invariably the district rate of wages is paid, and that is something that one can never accuse the majority of contractors (in London, at any rate) with. The cry of the contractors is, "I have taken this at a short price; rush it through." Nothing about doing the work well (they expect that, they will tell you)—do it quickly. If, in trying to follow out orders, the man makes a bloomer, he is stood off or sacked. Possibly the firm he has been working for is a member of the Contractors' Association; then good-bye to his chance of getting a job with any other firm in the Association.

I have before me a list of questions sent out by members to each other *re* workmen applying for a job. This precious document is marked "private," and the man can never know why he is not wanted. The whole thing is a scandal, and I am very much surprised at the editor, in his article last week, trying to uphold this system.

A friend of mine, a contractor, was circularised by Mr. Tate with a view to membership. Said he, "If I want any men I 'phone to the Union and expect them to send me capable men. If I meet the members of the Contractors' Association in open competition, more than half of them take an unfair advantage of me, by not paying the same rate for labour that I do, and yet I am to pay two guineas to get to know them personally. Where do I come in?"

I could not enlighten him, neither, I think, could Mr. Tate when he called; at any rate, he is not a member. If all the members of the Association paid the standard rate of wages, as recognised by the Government departments, L.C.C., borough councils, and the best of the contracting firms, each man when he left being given a discharge paper, with the reason of his discharge written upon it—not this hole and corner business—they might do some good. As it is, they are cutting each other's throats, getting the trade generally a bad name, and making municipal wiring an absolute necessity.

Even when some members of the Contractors' Association get jobs on which it is distinctly specified that the district rate of wages must be paid, they get out of it. The mean tricks to which they stoop are enough to sicken one, and they call it business. If they caught the man they have been robbing, perhaps for months, of a halfpenny or a penny an hour, with a coil of wire, I guess they would call that by a different name.

A young friend of mine has had a by no means curious experience (for our trade). After serving a five years' indentured apprenticeship with a well-known North of England firm, he came to London. He obtained work with a building firm, and was with them nearly 12 months. His next job was with a firm, which, I see by the list, is a member of this Association, as an improver. He was with them three or four months, and was then stood off to make room for a man between 20 and 30 years of age, who did not know a switch from a holder, but had a brother who was a charge hand for this firm. What yarns the contractor was told I do not know, but there is the fact. In about 12 months' time, I suppose, he will be a full-blown mechanic. And that is how wiremen are made by the Contractors' Association. I may add that my young friend holds two first-class City and Guild certificates for wiring and electrical engineering. What an outlook for our sons who are apprenticed!

I am sure most wiremen would like an answer from the contractors to the following question: Why is there such a vast difference between the estimates of various firms for a given job, and who suffers? A case in point—Receiving Homes, Wanstead, for West Ham Board of Guardians. Accepted price £744 18s. (very careful as to shillings); highest estimate £1,220. It sets one thinking.

In conclusion, with Mr. Bostel, I am sorry to see Mr. Duncan Watson descend to personalities. Mr. Duncan Watson says he has not a monopoly of contracting. If he had, I am sure all wiremen would dine every day at Frascati's.

Trusting you will find space in your valuable paper for this side of the question.

W. J. Webb.

London, S.W., *November 12th*, 1910.

Humming of A.C. Motor.

I had the same trouble with a 1¼ H.P. motor, and reduced the noise considerably by placing about 1 in. of india-rubber under each corner of the motor.

E. S.

Torquay.

Review of Text-Book on "Applied Mechanics," Vol. V.

Your previous review of Vols. I to IV was stated in a somewhat happier vein, and contained more useful, stimulating suggestions than this one, which appeared in your issue of September 11th, 1910.

Nevertheless, you do kindly admit that "the difficulty has been overcome" by me of writing a book upon this somewhat "intangible" subject to the beginner. For, as you say, "it is only interesting to those who know it in an advanced manner . . . ." However, we must all admit that it is a most useful and necessary subject for many engineers, master mechanics, mechanicians and inventors.

I avoid as far as possible the use of numbers to the various figures in each of my ten books upon engineering subjects. I only do so in cases where the figures serve to illustrate in sequence, such a series of progressive problems or details, as will be found in the first five lectures, for which 86 figures were specially redrawn, and blocks made, by my publishers.

Now we come to the tail end, where the sting is to be found! I cannot agree with your complaint, that either this volume, or any of the previous four volumes, are too dear. Why, the very fact that new, or 8th, editions, were called for of Vol. I on "Applied Mechanics" (proper, and which is now printed); for Vol. II on "Strength and Elasticity of Materials"; and for Vol. III on "Theory of Structures" within a year of their having been issued, distinctly proves that their net or selling price is really very cheap, for the class of men for whom these books are intended.

You seem to forget that all my books are issued at their (so-called) published prices, consequently any one, or all of them, can be procured in this country at 25 per cent. discount, *i.e.*, at three-quarters of their published prices, from most booksellers. In fact, the average selling price of Vols. I to V is only 4s. 4d. for each copy. Think of that, and you must admit that both senior students and practical engineers are getting good value for their money, especially since Vols. II and III are now being so enlarged as to contain all up-to-date matter upon which you so ably commented.

This series of five volumes is written for engineers who are going in for their final professional C.E. and B.Sc. examinations, and consequently is not intended for the average beginner. For such, my "Elementary Manual on

Applied Mechanics" (which you reviewed so favourably) is much more suitable in every way. And it has this advantage, which will appeal to the student who "expects a lot for his money," that it is acknowledged to be, by all who have used it, the cheapest book (only 2s. 8d. selling price) for its size, exactitude, and wealth of good illustrations, which has yet been published.

I find from practical experience, not only in connection with universities and technical colleges, but also with my own system of "Tuition by Correspondence," that for one student who takes up "Theory of Machines," over 20 take each of the previously mentioned three subjects, as treated in Vols. I, II and III.

Finally, let me say that my publishers have had a very long and extensive experience with science and technical books. It is now over 50 years since they issued the first of the famous Prof. Macquorn Rankine's books, and they ultimately brought out every one of them! Consequently, I do not think that the opinion expressed in the last few lines of your review will be readily taken advantage of by any other author and publisher. At least, I can say this, that personally, as far as pecuniary profit is concerned, the author will assuredly be disappointed by the small returns for the great amount of time and work thus involved.

Andrew Jamieson.

16, Rosslyn Terrace, Kelvinside, Glasgow.
November 14th, 1910.

Replacing a 240-B.H.P. Diesel Engine by a 280-B.H.P. Electric Motor.

With regard to your reference to the above in your issue of October 28th, 1910; although a cheap and maybe effective advertisement for your Town Council electricity supply, it may also give your readers a wrong impression regarding the reliability of the Diesel engine. I therefore wish to state the following facts regarding the matter :—

1. The writer installed this engine, and it was put to work November, 1906.

2. The crankshaft broke on January 31st, 1908. An examination was made by the representative of the firm and the writer, when it was found and agreed that the cause of the accident was due to the heating of the two middle bearings, these being down $\frac{1}{16}$ in., and that much out of alignment with the two outer bearings, and the engine had been run under this distressed condition until the shaft broke.

3. A new shaft was fitted, and the engine restarted on May 28th, 1908.

4. Crankshaft again broke, October 7th, 1910.

5. The engine had just been overhauled.

6. The "fitter-driver" and "foreman fitter" both denied all knowledge of any of the bearings having been hot.

I will now deal with paragraphs Nos. 4, 5 and 6 in rotation.

4. On examination by the firm's representative and the writer, we found that the crankshaft had broken through the web of the middle engine. The fracture had started at the fillet of the shaft journal, and extended diagonally through the web; a great part of the surface of the fracture showed bright—due to abrasion caused by the panting of the parts together under the working stresses.

The representative of the firm agreed with me on this point, and also that the fracture had been of gradual development—*i.e.*, had gone on slowly until the section of the web was reduced to the breaking limit, the fracture showing this clearly by the newly broken portion.

The two bearings showed that the white metal had been so hot as to fuse, and on being gauged they were found to be down $\frac{1}{20}$ in., and that much out of alignment with the two outer bearings. This was mutually agreed, also that these bearings being out of line was the direct cause of the shaft breaking.

5. "The engine had just been overhauled," but, according to the driver's and foreman fitter's testimony, no examination had been made of the shaft or its bearings. The driver further informed the writer that no keeps had been lifted nor bearings or shaft examined since the shaft was fitted, May 28th, 1908, *i.e.*, a period of two years and four months. I therefore think I am right in contending that, if a very natural examination of the shaft had been made during the last overhaul, the fracture in the shaft would have been too glaring to have escaped observation. The fracture would have been reported, and the engine not put to work in a defective condition.

6. Regarding the denials as to bearings having been hot; throughout the writer's long experience he has always found that if a bearing gets so hot as to fuse the metal, due warning is given of the fact by smoke and smell, and the Diesel engines have not got over this old-fashioned and obnoxious way of expressing their condition.

After the shaft was lifted and the bottom bearings exposed, both the driver and the foreman fitter acknowledged that the bearings had undoubtedly been hot. The writer is also sure, after a careful examination of the metal in the bearings, that this heating had occurred some months previously.

In conclusion, I may add that I have at work in this town Diesel engines of 1,360 B.H.P. (collective), one of these engines being of the same make and a duplicate of the engine under review, and it has been at work since February, 1904, until the present day, and has never given any trouble with crankshaft or other important parts, and the same can be said regarding all the others.

J. Houston.

Sunderland, *November 14th*, 1910.

Unfair Methods: A Disclaimer.

We have been consulted by the firm to whom somewhat pointed reference is evidently made in the leaderette entitled "Unfair Methods" in your issue of the 28th ult.

As we pointed out at our interview with you, our clients object as much as you do to depreciatory comparisons with rival firms. It, however, came to their knowledge some time ago that competing firms were circulating misleading diagrams and circular letters depreciating their goods by name (copies of which are in our possession).

Our clients were therefore compelled in self-defence to prepare diagrams for the information of such of their customers as had been misled, and which would also enable their representatives to put matters in their proper light.

No circular such as you refer to has been issued by our clients, but a draft memorandum was prepared for our clients' agent's own use, which has not been circulated or even finally settled. If any copies of this memorandum have come into the possession of third parties, it has been without our clients' knowledge.

Our clients are prepared to accept the assurance you gave us that you had no animus against them in publishing the leaderette in question, and that you would willingly publish any explanation we might send of the real facts of the case.

We shall therefore be obliged by your giving equal prominence to this letter as to the article complained of.

The delay in sending you this letter has been caused by the necessity of making inquiries in India.

Barber, Young & Co.

London, E.C., *November 14th*, 1910.

Trouble with a Mine Motor.

Having had a great deal of trouble with a coal-conveyor motor, I should be obliged if any of your readers could give me some explanation, as there is a difference of opinion here as to the cause of the trouble.

The system used is concentric, working at 500 volts, the cables being lead-covered and wire-armoured, the negative conductor, lead cover, and wire-armouring being all joined together throughout and connected directly to earth at surface. The conveyor is 3,000 yards from the generating house, and the motor is of 8 H.P.

This motor never gave the least trouble till, in compliance with the Mines Regulations, an earth wire was connected from the negative terminal to the frame of the machine. About four hours after this was done the armature went to earth, several coils being burnt out, the earth taking place

at the ends of the slots. A new armature was then put in, but this only ran a few days before it, too, went to earth at the slot-ends. Since then we have had trouble due to other parts of the machine going to earth, and at the same time find it impossible to obtain sparkless running as before.

An explanation of the above trouble—which, I am sure, is due to some outside source—and any suggestion which will be likely to afford a remedy, will be greatly appreciated by

Colliery Electrician.

Speed Regulation of Three-Phase Motors.

With reference to the paper read by me before the Iron and Steel Institute in September last, which was abstracted in your issue of October 14th, my attention has been drawn by Dr. A. Scherbius to the fact that an error has been made in my descriptions of the Scherbius and Krämer systems of speed regulation.

The annexed illustrations are reproduced from my paper and carry the same numbers. The arrangement shown in fig. 3 was attributed by me to Dr. Scherbius, but it is really due to Mr. C. Krämer (the inventor of the arrangement shown in fig. 5 of the paper), and was first described in the German patent No. 169,452.

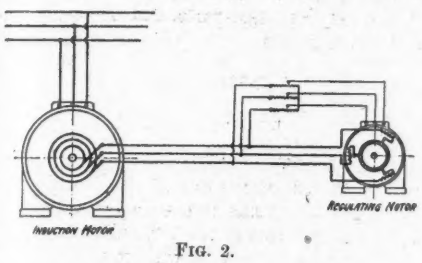


Fig. 2.

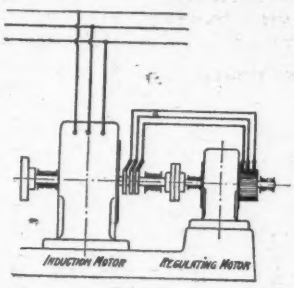


Fig. 3.

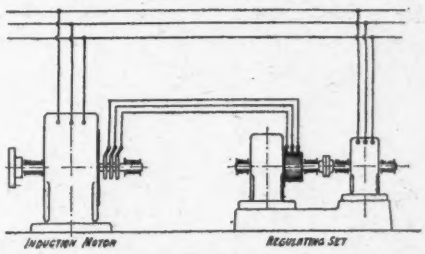


Fig. 4.

The arrangement shown in fig. 4 was correctly attributed to Dr. Scherbius; it was first given in the German patent No. 179,525.

The diagram of connections shown in fig. 2 is in reality a general diagram applicable to both the Krämer and Scherbius systems.

J. J. Elink Schuurman.

London, *November 14th*, 1910.

A Glasgow correspondent has omitted to send us his name and address.

LEGAL.

Gill *v.* J. Stone & Co., Ltd.

(*Concluded from page 775.*)

Mr. Dugald Clerk said he had examined the plaintiff's specifications. A very valuable step forward was made in train-lighting work when plaintiff introduced his two-battery system. It enabled one battery to be charged whilst the other was acting as a regulator for the lights. The introduction of the resistance in the 1899 specification had for its object the keeping of the lights steady, no matter what the movements of the train might be. This had been the inventor's object throughout, and he had succeeded very well indeed.

Cross-examined by Mr. Astbury, K.C., Witness said that, apart from plaintiff's system, he had never seen the adoption of the mechanical governors on electrical train-lighting machinery for the purpose of cutting out the resistances. He quite agreed that the rocking lever was a perfectly known mechanical contrivance, but it was part of an ingenious combination.

At the time plaintiff issued his two-battery specification, the idea of using two batteries, one for charging, and the other for discharging, was very old?—In other connections, yes, but not in regard to train lighting.

Cross-examined with regard to the plaintiff's patent cable, Witness agreed that at that time the rendering of a conductor non-inflammable was well known.

This concluded the plaintiff's case, and Mr. Colefax addressed his Lordship. The first point, he said, was whether or not the notice of resignation Mr. Gill gave on June 3rd actually terminated the agreement between the parties, or whether Clause 8 of the first agreement was operative to determine what royalties should be paid to plaintiff. He contended that the defendants could in no way have accepted Mr. Gill's letter of resignation in the light of a notice terminating the agreements; it was merely a notice terminating his position as manager only. If his Lordship should think that the matter had to be determined under Clause 8, then he submitted that the whole of the cross-examination only intensified the case for the plaintiff, because it went to show that the parts of the combination were old, and if that were so, it only tended the more to show that the value of the monopoly rested in the combination as a whole. It was in evidence that the defendants sold the installation as a whole, and their profits on it had been taken as a whole. Throughout, Messrs. Stone had never attempted to sell the system in parts, except for renewals. This being so, plaintiff was entitled to be paid royalty upon the combination as a whole, quite independently of the question whether this or that part were under old patents.

Mr. Bousfield then opened the case for the defence. The question was, he said, what effect the notice given by plaintiff had upon the future relations between the parties. It had to be determined by his Lordship whether they were governed by Clause 8 of the original agreement or by Clause 2 of the third agreement, which provided that plaintiff should receive a royalty of 10 per cent. on the actual price received by defendants on all fittings and apparatus supplied by them for the lighting of railway carriages; also, among other things, that plaintiff should receive 10 per cent. on the actual price received by the firm for all spare parts and renewals of parts, whether or not the same could be supplied by third parties without infringement of the patent rights of the plaintiff, except under certain circumstances. Clause 3 of the same agreement provided that so long as he was the manager of defendants' electrical business, and the agreement under which his managership was renewed remained in force, plaintiff should receive the royalties provided on the very liberal scale of Clause 2 of the third agreement. Then there was a further provision that when the agreement came to an end plaintiff should go back to Clause 8 of the first agreement and receive royalties under that clause. That, counsel contended, was the only common-sense interpretation of the position. Clause 5 of the third agreement contemplated the possibility of an assignment or transfer of the defendant firm to a limited company, and its meaning was quite clear. An event was then contemplated which would transfer Mr. Gill to new masters, and it was not desirable that he should be compelled to enter into a new service or that the new owners should be compelled to employ him without a mutual consent on both sides. The clause, therefore, put upon Messrs. Stone the obligation of giving to Mr. Gill information of such transfer in time to allow plaintiff to give six months' notice terminating his engagement. But the clause said that he should give such notice to Messrs. Stone & Co., not to the new company, whereas, as a matter of fact, plaintiff's letter of June 3rd was a notice given to his new employers and not to the original firm at all.

His Lordship asked why, if counsel's argument applied to plaintiff's notice, it should not also apply to notice of termination of the agreements. It might be argued that the termination of the agreements could only be given by the original firm, and not by the limited company, because the language of the agreement under that head was precisely the same.

Mr. Bousfield disagreed, submitting that what Clause 5 dealt with was a particular set of circumstances. If this view of the matter were correct, then the question to be decided was what was plaintiff entitled to under Clause 8 of the first agreement. Proceeding to deal with the case on this assumption, Mr. Bousfield said that the whole of the system of carriage lighting sold by defendants was contained in the 1894 patent. It was a complete system from its earliest inception, and all the subsequent patents did not alter the character of the system, but simply improved certain parts of it. It was therefore not possible for his learned friend to contend that the system must be treated as a whole. Whatever the rate of royalty might have been when all the patents were alive, it certainly could not be applied to a period when two or three of the patents comprised in the system had expired, leaving the remaining patents merely patents for the improvement of parts of the system. For instance, the character of the dynamo used did not make any difference to plaintiff's link patent for suspending the dynamo under the railway carriage, and yet, if plaintiff's contention was the right one, the more complex the dynamo might become, and the more defendants might add to it, the more they would have to pay plaintiff, simply because they used his link-suspension device. Dealing with different patents and the claims arising thereon,

counsel said that the use of two accumulator batteries, one supplying the lights whilst the other was being charged, was an old system, and had been devised in connection with train lighting for some time. The real invention of plaintiff did not lie in the dynamo or the lights or the accumulators, but in the rocking lever, which was a mechanical device by which the connections between the dynamo, lights and batteries were made, and reversed, at the proper time. That was plaintiff's patent, and upon that only he ought to be paid. In respect of plaintiff's claim on a magnetic switch, Mr. Bousfield said that the switch now used by the defendants was entirely different in construction and acted in a different way. The only similarity between the two switches was that they were both magnetic, but plaintiff claimed that, because it was magnetic, he was entitled to a royalty upon it.

Mr. James Swinburne was called on behalf of the defence. He said that in 1894 it was recognised that the difficulty in the matter of train lighting was the variable speed of the dynamo. Several methods had been proposed to get over this difficulty, but Mr. Gill's method of a slipping belt was at the time quite new, and was the best solution to the problem. The problem had been solved in other ways, but Mr. Gill's was the best. It was an ingenious arrangement.

Mr. Bousfield, K.C.: It was suggested that the link suspension of the dynamo was a matter of great importance. Is there any difference in suspension by a link or by a sliding block?—If the dynamo is hanging on its centre, and is able to adapt itself to the changes in the length of the belt, there is no difference.

With the link arrangement, Witness added, the patent was really comprised in the screw adjustment, the movable link, and the rod which held the screw. Is there nothing in the dynamo?—No, the attractive feature of this patent is that it does not restrict the type of dynamo to be used.

Further examined, Witness said that the double-battery system was at the time of plaintiff's patent ordinarily used in electric lighting, and train lighting was merely electric light upon a moving carriage. Ever since batteries were first used, there was a difficulty about pressure, the batteries and the lamp not synchronising. There were two ways of overcoming that difficulty: one by using one battery with switches so arranged that the dynamo took in a few more cells than were feeding the lamps — this system, however, meant a very complicated switch, and furthermore, some cells were charged more than others; the other method was to use two batteries, one for discharging and the other for charging. He did not know whether such a system was actually used on English trains at the date plaintiff issued his patent, because in those days train lighting had not developed to any great extent. In 1895, however, there was a specification filed at the Patent Office for a two-battery system of train lighting, and as far back as 1882 there was Handford's specification for a two-battery system. In plaintiff's system, Witness continued, all the work was done automatically, and the kind of batteries, dynamo, or lights used did not affect this automatic system at all. The working of the switches automatically instead of by hand certainly involved ingenuity in coupling up the various contacts so that they performed their duties at the right moment. As regarded the magnetic switch used for cutting out the resistances, it did not matter what kind of dynamo, batteries or lamps were used, that switch would still perform its cutting-out operation. There was nothing in making the switch operate the lamps; where ingenuity did come in was in the arrangement of the switch whereby the possibilities of short-circuiting were prevented, and which made it perform with precision all its various functions. The whole of the invention and designing was contained in the switch itself. The particular form of the switch was as old as the hills, viz., the electromagnetic switch, but previous to plaintiff's application he had never heard of such a switch being applied to train lighting. The only novelty about it was plaintiff's application of an old form of switch to a train-lighting installation.

Questioned with regard to the cable claim, Witness said that away back in 1881-2 cables were wrapped outside with a waterproof covering, and such cables were known in America as underwriter's cables. In these cables asbestos was the material used, but although it was an insulating material it would not stand bending about. Witness did not know of any case before plaintiff's patent of putting fireproof material between the insulating material and the conductor. Such a system certainly lessened the risk of fire by internal heating, viz., the over-heating of the conductor.

This concluded the evidence for the defence, and Mr. Astbury, K.C., addressed his Lordship, and echoed for the most part Mr. Bousfield's arguments when opening the case for the defendants. He argued that it was impossible for plaintiff, having terminated his agreement as manager, to expect to retain, excepting, of course, the £500 a year, all the advantages he enjoyed whilst holding that position. In the course of further arguments, Mr. Astbury said he hoped his Lordship would not think that his clients wished to treat plaintiff shabbily. On the contrary, they wanted him to have his full monopoly rights, but he could not possibly claim a royalty on the whole installation. Because, for instance, plaintiff had added another battery to the old single-battery system, as patented by him in 1894, that did not make the whole installation a new combination.

Mr. Walter replied to the arguments for the defence, and submitted that the position taken up by the defendants was absolutely untenable.

Mr. Justice Swinfen Eady, delivering judgment, reviewed the circumstances, and said that according to the agreement of June, 1893, Mr. Gill became manager for a period of seven years from January 1st, 1893, and by Clause 2 of the same agreement he was to receive by way of payment a salary of 100 guineas a year, and then Clause 3 provided for a commission. This commission was to be paid at the rate of 5 per cent. on the selling price actually received by Messrs. Stone & Co. in respect of all electrical fittings and appliances in the then current year until the aggregate sum received by Messrs. Stone should amount to £3,000. Clause 4 provided the time when the commissions should be paid, viz., that they should accrue due and be payable to Mr. Gill within the respective months next succeeding those upon which fell the quarter days respectively specified for the payment of his salary. The seventh clause referred to the power of dismissal of the plaintiff. Down to that point the agreement had provided for salary, commission and terms of engagement. Then Clause 8 of the agreement provided for a different matter. It was contemplated that plaintiff would make inventions and take out patents in connection with train lighting, and so Clause 8 provided that all such patents or protection should, upon the request of J. Stone & Co., at their expense, and upon the terms of their paying royalties in respect thereof at the rate of 10 per cent., be assigned to J. Stone & Co. Clause 9 provided that in the event of the firm determining to allow a patent to lapse they should not be bound to give notice to the plaintiff. This agreement had been read and commented upon, and the view of it taken by Mr. Astbury seemed the correct view. The agreement comprised two parts: first, the engagement of plaintiff as engineer at a salary and commission for a fixed term of years, and if that were all, at the end of the seven years the managership would come to an end. But Clause 8, the second part of the agreement, provided for the payment of royalties on patents, and was simply a continuance. It also provided that plaintiff should at all times use his best endeavours, and the royalties payable were obviously to be paid during the whole length of the patents. Clause 8, therefore, did not come to an end when the appointment of manager ceased, but the payments in regard to salary and commission did come to an end. There was a distinction between the payment of salary and commission as manager, and royalties in connection with the patents. Then it appeared that in 1896 it was arranged that instead of salary and commission, as under the first agreement, plaintiff, as manager, was to have a fixed salary of £500 a year, and a supplemental agreement was entered into. Clause 2 said that, notwithstanding the first agreement, Messrs. Stone should be at liberty to assign or grant such patents, patent rights and licences in respect of any invention of Mr. Gill, and upon such terms as they and the plaintiff might think fit, Messrs. Stone & Co. paying to the plaintiff one equal sixth part of their net receipts in respect of any such assignment or grant. It was said that if the patents were assigned to Messrs. Stone & Co. they would have the right to grant licences to whom they pleased, and that this supplemental agreement was a restricting clause. In his opinion, however, there was no difficulty in seeing the view the parties really took. Under the first agreement it was provided that the patents should be vested in Stone & Co., so that they should have the sole right to manufacture. It was considered that Messrs. Stone should manufacture the apparatus themselves, and that they were to be at liberty to assign or grant licences upon such terms as they and the plaintiff might think fit. Clause 4 made a further provision in case of the sales amounting to a certain sum, but no question arose upon it. The parties went on under these two agreements until they had expired by effluxion of time. The seven years came to an end on January 1st, 1900. In that year the third agreement was entered into, and the fresh question now between the parties was whether this third agreement was still subsisting. The circumstances leading to the third agreement had been stated by the plaintiff in his evidence. He found that he was not getting royalty upon certain spare parts, and he objected to this, and said that the spare parts were covered by the patents. Plaintiff also said that he had always been getting 10 per cent. upon the whole turnover from the apparatus before the 1900 agreement. This discovery of his in regard to the spare parts led to the third agreement being entered into, and there was no evidence on the other side to contradict this explanation. This third agreement provided that the two prior agreements should be deemed to be renewed between the parties for three years certain until determined by six calendar months' notice in writing on either side to be given as provided by Clause 5 of the agreement (which provided for the mode of serving the notice), but so, nevertheless, that the first agreement should be read as modified by the agreement endorsed thereon, and that both of such agreements should be read as modified by the terms of the present agreement, that plaintiff should receive a royalty of 10 per cent. on all spare parts and renewals of the apparatus, and by Sub-Clause C of the same clause it was held that no royalty should be payable in respect of J. Stone & Co.'s receipts for labour employed in the wiring, fitting or testing any apparatus. Clause 3 provided that on the expiration or sooner determination of the agreement, the above provision should cease, and the rights, duties and obligations of the several parties should thenceforth be governed by Clause 8 of 1893. Defendants contended that that event had happened, all agreements had been terminated, and the rights, obligations and duties of the parties were now to be governed by Clause 8 of the first agreement. The fifth clause provided that in the event of assignment and transfer by Stone & Co. of their business to a limited company, either party might determine the appointment of plaintiff as manager by six calendar months' notice in writing. The parties went on under this agreement until the middle of 1908, when, in June of that year, a notice was given by the plaintiff. In order to consider the effect and operation of that notice, his Lordship had to look carefully at the agreements. It was quite manifest that the third agreement was upon the same lines as the first and supplemental agreements, viz., that it was two-fold, the appointment of plaintiff as manager and the provision as to the royalties. Before plaintiff wrote the letter resigning his managerial position

with the firm, Messrs. Stone & Co. had sold their business to a limited company, but the parties had gone on without any fresh written agreement exactly in the same way as with the old firm. When plaintiff sent in his notice it was eventually accepted. He thought it was obvious from the correspondence that plaintiff intended to resign his position as manager. Later, after taking legal advice, the company took up the position that the third agreement had been terminated and that plaintiff's rights as regards royalties and accounts to be sent in were henceforth to be determined by Clause 8 of the first agreement. He (his Lordship) was of opinion that the effect of the notice given by plaintiff was to determine his position as manager at the expiration of six months, and that he did not determine the rest of No. 3 agreement. On the other hand, No. 3 agreement continued in full force and regulated the relations between the parties. It expressed clearly the arrangement by which plaintiff was to be paid on the lighting system and the spare parts and renewals. If plaintiff's notice was not effective to determine his position as manager, then it was wholly nugatory. He was of opinion that No. 3 agreement was still subsisting between the parties in respect of everything except the employment of plaintiff as manager, and his salary as such. That being so, then it followed that plaintiff was entitled to an account upon the footing of that agreement, and there was no dispute between the parties as to the amount plaintiff was in that case entitled to receive as royalty. The effect of Clause 2 of the second agreement was that defendants were entitled to grant patent rights and licences in respect of the plaintiff's inventions upon such terms as defendants and plaintiff might think fit, and the declaration ought to go in that form. Defendants counterclaimed for an assignment of the patents, and plaintiff replied that he had always been willing to execute proper assignment of the patents to the defendants, but there was disagreement as to the terms. This being so, and the parties being agreed that there should be an assignment, the form of the draft had better be decided in chambers. A question might be raised as to whether defendants were entitled to such assignment so long as any royalties were in arrear. He, however, would say nothing as to royalties being in arrear, because the dispute between the parties was really as to the amount claimed, and there was no indication of intention on the part of defendants to keep back moneys which they conceived to be owing to plaintiff. There was really no difficulty about declaring the rights of the parties in respect to paying any sum to which plaintiff might be entitled. The proper order would be an order directing an account, and on the counterclaim to say that the defendants were entitled to an assignment of the patents, it being referred to chambers to settle the form of the assignment, leaving it quite open at any future time for plaintiff to apply for the payment of royalty, and if it should then appear that any royalty was in arrear, the question of the assignment of the patents would then arise. A further question which arose was with regard to the interest. Interest would become payable to plaintiff for any sum actually in arrear as from the time it became payable. The only remaining question was as to costs of the action. In his view, plaintiff succeeded on the claim and counterclaim, and the result was that defendants must pay the costs of the claim and counterclaim up to the day of, and including, the trial before him.

Robertson Electric Lamps, Ltd.

In the Chancery Division on Friday last Mr. Justice Neville heard a petition by this company for the sanction of the Court to a reduction of its capital.

It was stated by counsel in support of the petition that it was proposed to reduce the nominal amount of the shares. The matter had been before the Master, who had certified that all the debts of the company had been paid with the exception of the weekly wages which, of course, went on from time to time. The nominal capital of the company was £100,000 divided in 10,000 shares of £10 each. Of these 6,700 had been issued, and it was proposed now to reduce the capital of the company by writing £6 10s. off the nominal value of each of those shares. That would leave the shares at the nominal value of £3 10s. each, and it was proposed to distribute the difference—£43,875—amongst the shareholders.

His Lordship: You are returning capital not required to the shareholders?

Counsel said that was so. All the debts were paid, with the exception of the weekly wages to the 300 employés of the company. The company had been an exceedingly prosperous one, and all the necessary resolutions had been passed and confirmed unanimously. Having regard to the prosperity of the company and to the fact that there were, in reality, no creditors, the use of the words "and reduced," as part of the company's title, should be restricted.

His Lordship sanctioned the reduction as proposed, and directed that the words "and reduced" should be used for one month.

Tramway Accident Claims.

At the Liverpool Assizes on Friday, November 12th, before Mr. Justice Avory and a jury, Miss Jessie Jane Marshall brought an action against the Liverpool Corporation for damages for personal injuries which she alleged were caused by the negligence of the driver of an electric tramcar belonging to the Corporation.

For plaintiff, it was stated that on Good Friday she and her brother were cycling home, when her cycle was struck by a tramcar coming at a fast rate behind, just as she was crossing the road. She was thrown off, and sustained concussion of the brain and other injuries.

Evidence was given by Miss Marshall and her brother, the latter deposing that had the car been coming at a reasonable speed there would have been ample time for him and his sister to have crossed the lines.

Counsel for the defence contended that plaintiff had not taken reasonable care, that the car was going only six or eight miles an hour, and that the cyclists crossed suddenly and unexpectedly in front of the car.

The Driver (who admitted he was not a regular motorman and occasionally did work as conductor) said plaintiff's brother crossed the metals when he was 15 yd. away, and then shouted to his sister "come on." She crossed within 2 yd. of the car.

The jury found for plaintiff, and awarded her damages at £400.

Mr. Justice Avory and a jury also had before them on November 11th a case in which the New St. Helens and District Tramways Co. were sued by Alfred H. Roden, a shore joiner in the Cunard Co. at Liverpool, for damages for personal injuries.

Counsel for plaintiff said that while he was driving a trap plaintiff's horse became restive through the noise created by the tramcar passing through a loop. The driver of the trap when 10 yards away signalled for the car to stop, but it did not do so, and a collision ensued. Through the injuries which plaintiff sustained he had lost wages amounting to £72 10s., besides having incurred other expenses.

For the defence it was urged that if any signal was given it was insufficient; and the car conductor denied that any sign was given at all.

The motorman said no noise was made by the car.

After much evidence and a long consultation, the jury found for plaintiff, assessing damages at £200.

Tottenham District Council *v.* Metropolitan Electric Tramways, Ltd.

According to the *Daily Telegraph* this case, which came before the Tottenham Bench on 10th inst., was a summons by the Tottenham District Council for the non-payment of a sum of £371 14s. 4d., balance of the general district rate for the half-year ending September.

The rate was in respect of the company's tramway system in the parish, which had been rated by the Council on the full net annual value. The company urged that the tramway came within Sec. 211 of the Public Health Act, 1875, which provides that a railway shall be assessed in the proportion of one-fourth of the net annual value. It was intimated at the opening of the case that the intention was to take it to a higher court, whatever the decision of the Bench might be. It was explained that the tramway was linked up with a light railway from Bruce Grove to Wood Green, which was admittedly exempted from the full rate; but Mr. Ryde submitted that as the tramway was constructed under the Tramways Acts, it was governed by the law relating to tramways, and not by the law relating to railways.

Mr. James Devonshire, the managing director of the company, said the company had paid a fourth of the rate. Up till 1904 the tramway was rated at a fourth of its net annual value.

The Bench decided that the tramway was not a railway within the meaning of Sec. 211 of the Public Health Act, and made an order for the payment of the full amount of the rate, granting the Council 10 guineas cost.

Action Against the Electric and Ordnance Accessories Co.

In the King's Bench Division, during the week, Mr. Justice Hamilton and a special jury heard an action brought against the Electric and Ordnance Accessories Co., Ltd., by the Warner Instrument Co., U.S.A., claiming the recovery of £2,602 which it was alleged was due as the balance of a minimum of royalties owing to them by defendants under a contract dated August 21st, 1907. It appeared that under that agreement plaintiffs transferred their European rights in the manufacture and sale of the Warner autometer, a machine for measuring the speed of motor-cars, &c., upon royalty, defendants guaranteeing a minimum amount. Defendants denied any liability, declaring that the French and German patents had expired before the date of the agreement, which was a fact that had been concealed from them. Further, they counterclaimed for expense they had been put to in erecting special machinery for the manufacture of the autometer. After hearing the evidence, the jury returned a verdict in plaintiffs' favour, but judgment was deferred pending argument on points of law.

The case came before his Lordship on Wednesday, November 16th, when his Lordship entered judgment for plaintiffs for an amount to be calculated, with liberty to the defendants to apply in case there should be any difficulty in arriving at the amount due.

Gould *v.* Lehwess.

(*Continued from page* 776.)

Mr. Chas. A. Gould, the plaintiff, said he was the owner of the patent rights for the Gould Storage Co. in foreign countries. There was a Gould Storage Co. in America, with a capital of $5,000,000. The Gould storage battery was used for many purposes of traction, chiefly for heavy work. In 1906 defendant told him that he controlled the Electrobus Co., and that he wanted a good battery. Witness said he would take $50,000 for the English rights. Dr. Lehwess then suggested the formation of a company with a cash capital of $125,000, he (witness) to have 55 per cent., and this was agreed to. He was satisfied that defendant was a man of money, and controlled the London Electrobus Co. As a result of

these representations, 15 batteries were sent to London, with, he believed, one extra. Dr. Lehwess paid $10,000 into a bank, and subsequently cabled, "All shares issued cash ; about 4,000 reserved." Witness had not received a penny for the batteries sent over.

Mr. Wm. F. Gould, son of the plaintiff, gave corroborative evidence.

Mr. Duke, K.C., said Dr. Lehwess was prepared to take all responsibility for the ambiguity of the cablegram—"all shares issued cash about four thousand reserved"—but it was beyond conception that a shrewd American gentleman could suppose from it that he was about to receive £13,750 in cash for a patent that had not then been tested, and as to which tests were yet to be made. Ambiguity did not constitute fraud. From the beginning, in 1908, there was trouble about the efficiency of the batteries, and avowedly the tests that were said to have been made were secret tests. The Electrobus Co. was willing to buy a battery that would work, but until they had fulfilled the test, there was no obligation on the part of the defendant to take the batteries.

Dr. Lehwess, on oath, said the capacity of the batteries was not satisfactory. It was untrue to say that he agreed to pay 55 per cent. each for the shares in the company to be formed. At the time of the alleged transaction he held the majority of the shares in the Electrobus Co. The cablegram which led to the misunderstanding was an uncoded message, which was shortened by his secretary, and was never intended to mislead the plaintiff in any way.

On Friday further evidence was led for the defence, and at the close of the day's hearing it was intimated that a settlement of the action was possible.

When the Court resumed on Monday, Mr. Gore-Browne, K.C., said that on the previous Saturday the parties had met and come to terms, one of the terms being that a certain sum of money was to be paid. Both sides withdrew anything which might have been said imputing anything to the other side.

Mr. Atkin, K.C., for Mr. Gould, concurred, and said the record would be withdrawn on the terms agreed to.

His Lordship remarked that he would say nothing except that he was glad to hear of the settlement. But as the case had been heard before a jury, a juror had better be withdrawn.

A juror was accordingly withdrawn, and his Lordship ordered the payment out of court of an amount paid in as security for costs.

Marconi and Others *v.* British Radio-Telegraph and Telephone Co., Ltd.

This action was mentioned again to Mr. Justice Parker in the Chancery Division on Tuesday last.

Mr. T. Terrell, K.C., stated that he had consulted the other parties interested, and they were agreed that December 12th was a convenient day for commencing the hearing if his Lordship could give them that date.

Mr. Justice Parker said that would be convenient to him.

Mr. Terrell said it would be necessary to fix up a lot of apparatus, and asked that if convenient the parties might have the Court on the previous Saturday.

His Lordship said that he had no objection. No doubt the Courts Superintendent would give the parties facilities.

Mr. Terrell said they would arrange with him.

Griffiths and Another *v.* Benn.

In the King's Bench Division on Tuesday there was opened before Mr. Justice Ridley and a special jury the action of Griffiths and Another *v.* Benn, by which the plaintiffs, William Griffiths and Benjamin Harry Bedell, claimed damages against Sir John Williams Benn for libel, slander and disparagement of goods.

The case arose out of the adoption and subsequent abandonment of the "stud" system of electric tramways by the L.C.C. on their Mile End Road route. The defence was that the statements of fact in the alleged libels were true and the comments were fair.

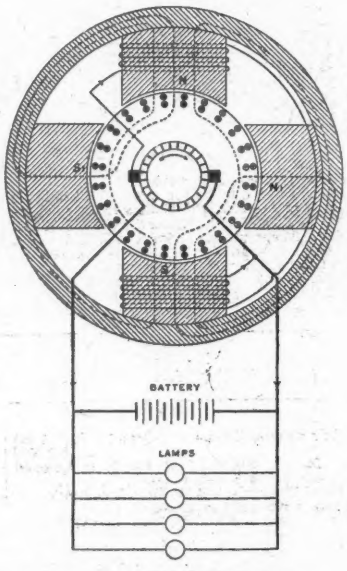
Mr. F. E. Smith, K.C., in opening the case for the plaintiffs, said that Mr Griffiths, in addition to other business, carried on with Mr. Bedell, his co-plaintiff, a business called the G.B. surface-contact system for the construction of tramways. What had been said, about which the plaintiffs complained, had had the effect of ruining that business. The system was the invention of Mr Bedell, an electrical engineer, and in conjunction with Mr. Griffiths a flourishing business was carried on. Now there was no business. He would show by his evidence that the plaintiffs had succeeded in doing what no inventor had done before, and had produced a most valuable invention. He would show that by the G.B. system, if properly laid down, no stud could become alive through leakage. If the language that had been used by Sir John Benn was true, it would be foolish for any municipality to lay down the G.B. system. Sir John had said in effect that it was a fraud and a rotten system. Among the many advantages of the G.B. system was that the studs did not project above the roadway, and if any stud became alive through failure of the mechanism there was an appliance in the car by which it was at once detected. It had proved a great success at Lincoln, where it had had a fair trial, but it had not had a fair trial in London. Sir John Benn had described it as "jerry built," "live stud," and as producing "roast horses." The cost of laying it was a little more than that of the overhead system, but a good deal less than that of the conduit system.

(To be continued.)

ELECTRICAL ACCESSORIES FOR MOTOR-CARS.

The magnificent show of automobiles at Olympia last week, while profoundly impressing upon the mind of the visitor the extraordinary development which the industry has attained in a remarkably short period, and the excellence of design and workmanship displayed, had one deplorable feature from the electrical point of view : we believe there was but a single exhibit of electrical vehicles in the whole show—that of the Electric Vehicle Co. Even the British Electromobile Co. showed petrol cars ! After this, it is somewhat cold comfort to reflect that the motor-car is absolutely dependent upon electricity for the ignition of the odorous mixture by which it is propelled, and that the apparatus employed for this purpose, and for the electric lighting of the cars, have been brought to an exceedingly high degree of perfection. The magneto, although the earliest type of dynamo, was for long years neglected and despised ; but the internal combustion engine created a demand for a small, compact generator, and in response there has been evolved, a wonderfully efficient machine, presenting a striking contrast with the magnetos of but a few years ago. Numerous examples were shown at Olympia ; coil ignition devices were also shown in great variety.

The Bosch Magneto Co., Ltd., showed two new features—dual ignition, and auxiliary ignition. The former has for its object the ignition of the charge simultaneously at two points in the combustion chamber, to accelerate the process of explosion, and to increase reliability and efficiency. Moreover, it reduces the importance of timing the spark, which is only necessary to compensate for the delay in the ignition of the charge. In the Bosch double-pole magneto both ends of the secondary winding on the armature are insulated from earth and connected to the ignition plugs, which can be used either together or separately, the latter facilitating the starting of the engine. The modifications required



Section of "C.A.V." Dynamo.

in the design of the magneto and the allied parts for this purpose are few and simple ; the secondary armature winding is entirely separate from the primary, and both ends are connected exactly as the single insulated end used to be, the current going by earth from one plug to the other. By short-circuiting either plug, the other alone becomes operative, concentrating the whole E.M.F. of the coil upon the latter ; this is effected by means of a four-way switch, which puts either or both sets of plugs in action, or shuts off the magneto altogether. The auxiliary ignition is provided for use in starting the engine ; it involves the employment of a switch, a small dry battery or accumulator, and an intensity coil. The battery and coil are short-circuited through the low-tension contact-maker, and when this is opened by a cam the coil discharges through the primary of the armature, inducing a discharge in the secondary circuit ; the effect, in fact, is to add a wave of current from an external source to the wave normally produced by the magneto primary, the latter unaided being too feeble for the purpose when starting up. As the external and internal E.M.F.'s must be added, a two-part commutator is provided in circuit with the battery to keep the polarity right, when there are more cylinders than one.

The Simms Magneto Co. also showed both dual ignition and auxiliary excitation systems on similar lines. Messrs. Lodge Bros. & Co. exhibited a simple device for testing the ignition, consisting of a small vacuum bulb with sparking points, normally short-circuited by a spring contact ; on opening the latter, the spark current is obliged to pass through the bulb, which offers a trifling resistance to it, and thus does not hinder the ignition while in action. The "spark lamp" shows at once, by lighting up,

if the ignition is in efficient operation. The device is easily fixed on the terminal of any sparking plug. The same firm also showed an ignition switch for use with trembler coils, which automatically reverses the direction of the current across the platinum points every time it is operated, so as to prevent pitting of the points. The switch is combined with a three-way switch for bringing either of the two accumulators into use, or both in parallel.

The use of small dynamos to effect the lighting of the car appears to be becoming quite popular, judging by the number of exhibitors who showed apparatus for the purpose. The system first put forward, we believe, was the Leitner system, which we described some years ago; in this a dynamo of special design was employed, in conjunction with a set of accumulators, giving constant voltage on the lamps at all speeds. This system was exhibited by the Rotax Motor Accessories Co. Complete systems of dynamo, battery and lamps were shown by Messrs. Peto and Radford, Messrs. Jos. Lucas, Ltd., Messrs. C. A. Vandervell, Silverlyte, Ltd., and others. In the C.A.V. system of Messrs. Vandervell the dynamo armature is provided with a free-wheel clutch, so that no cut-out is necessary, as when the engine is stopped temporarily the armature runs as a motor on no-load, taking only a trifling current from the battery. The machine is, of course, switched off in the case of a long halt. The dynamo (see figure) has two poles N_1 S_1, without any winding on them, and two subsidiary poles N S, provided with a shunt winding; when the flux is not distorted, it passes only through the latter, as shown by the thin dotted lines. The unwound poles are excited only by armature reaction. The coils shown black are short-circuited by the brushes, which are set in the neutral position with regard to the poles N_1 S_1; the current in these coils tends to produce a flux through the poles N_1 S_1, and thus distorts the field set up by the poles N S, producing a resultant field in a diagonal direction through the armature core, and the magnetic axis thus rotates through an angle depending upon the current in the short-circuited coils, and therefore upon the speed. Directly the distortion commences, the working current in the armature winding also exercises an influence upon the magnetic system, the armature magnetism possessing a component in opposition to that of the poles N S, which, therefore, tends to reduce the flux produced by the field-magnet winding, and this varies with the speed also. The result is that a constant output is obtained over a very wide range of speed, enabling a small battery to be used without fear of charging it at an excessive rate. The dynamo is beautifully made, and the system is very thoroughly worked out in every detail, five dynamos being standardised, and 18 equipments.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

E.M.F. Manufactures.

We have paid a visit to the new premises of Messrs. E.M.F., Ltd., at 212 and 213, Upper Thames Street, E.C., a position more centrally placed for the convenience of the trade than their old premises, and with office, store and showroom accommodation far

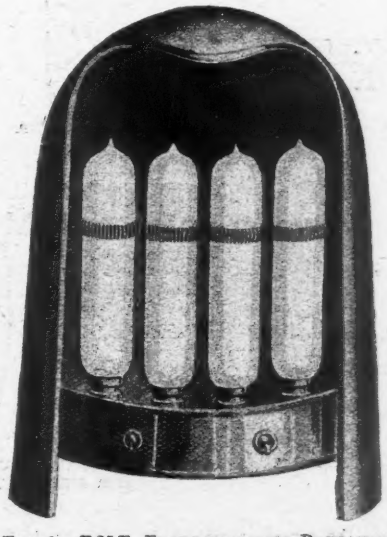


Fig. 1.—E.M.F. Featherweight Radiator.

better than it was possible to have at their old address in Ironmonger Lane. Upper Thames Street is becoming more and more an electrical thoroughfare. The basement of the building is set apart for store purposes and for counter trade, the ground floor, which communicates with the basement by means of a goods lift and a private stairway, is set apart for a showroom, where a wide range of electrical manufactures is displayed, with window showcases out to Upper Thames Street. The floor above is fitted up as a counting-house, and has offices for the executive. In the showroom there are on view E.M.F. metal-filament and tantalum lamps, Bastian electric heating apparatus, luminous radiators, of which a number of designs are made, an effective one in antique copper appearing in the accompanying illustration, a varied collection of electric light fittings, including an inexpensive line

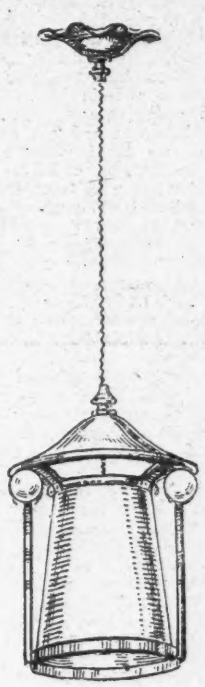


Fig. 2.

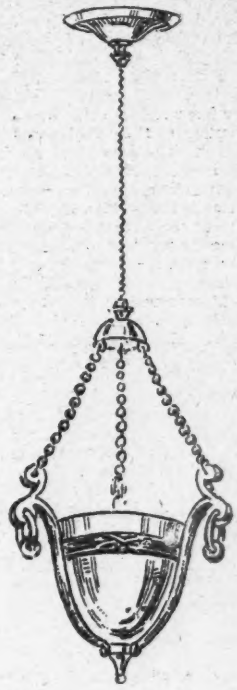


Fig. 3.

E.M.F. Fittings.

of light cast electroliers, table standards in oxidised silver and other finishes, Holophane globes and fittings, a special and substantial line of fittings for railway station, goods yard and dock lighting, mill and ship lighting fittings, street lighting lanterns, &c., also a large stock of some 150 different patterns of glass shades. There are, of course, many other devices on exhibition, but we have mentioned the foregoing to indicate generally the class of manufactures, many of which are produced at the E.M.F. works at Walsall; the firm also does designing specially for the trade. In two of the accompanying illustrations some examples of pendant fittings are depicted.

The Dionic Water Tester.

Recently Messrs. W. P. Digby and C. W. V. Biggs devised a new electrical method of testing the degree of impurity of water, which is likely to find many useful applications. It was described in an "original communication" to the *Journal* of the I.E.E., and has

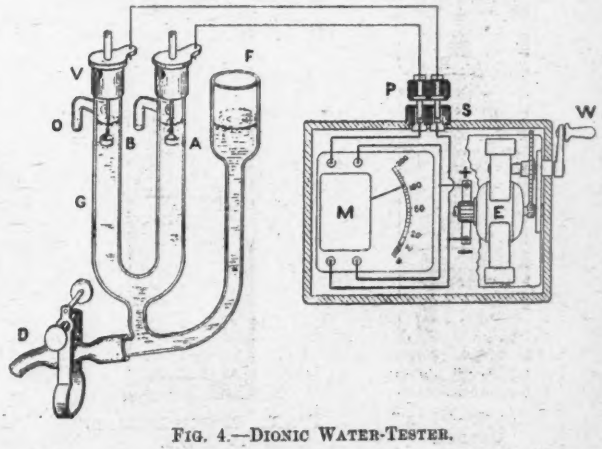


Fig. 4.—Dionic Water-Tester.

also been explained to the Faraday Society. A brief notice of it appeared in our pages at the time. The method depends upon a test of the conductivity of water by means of the "Megger," and the apparatus, as the result of two years' research by the inventors and the makers, has just been put on the market under

the above title by Messrs. Evershed & Vignoles, Ltd., of Acton Lane Works, Chiswick.

The principles of the method, and the form which the apparatus has taken, are described in an admirable brochure by Mr. S. Evershed, who has carried out a number of investigations into its working. It depends upon the fact, established by Kohlrausch, that the conductivity of pure water containing any electrolytic substance in solution is due almost entirely to the dissolved substance, and hardly at all to the water itself; also, that in a very dilute solution the conductivity is proportional to the percentage of the substance dissolved, *i.e.*, to the number of ions present.

The Dionic Tester, of course, does not indicate the identity of the impurity—only its degree. The apparatus is shown in fig. 4; G is a bent glass tube containing the water under test, A and B being the platinum tube electrodes, and D a drain pipe. The water is poured into the funnel F and flows out through the overflow pipes O, thoroughly washing out the tube; air-vents V are provided. The electrodes are connected to a direct-reading conductivity meter M and a D.C. generator E driven by the handle W, the connections being made by a plug and socket P S. On turning the handle the pointer of the meter is deflected, and comes to rest in two or three seconds, indicating the conductivity of the solution, so that the test is made in an extremely short time. The resistance of the path through the water is so high that no appreciable error is caused by the formation of gas on the electrodes, and the bubbles travelling upwards do not affect the test; but hardly any gas is formed in so short a time, the current never exceeding 0·004 ampere. The back E.M.F. of polarisation is allowed for in calibrating the meter at the rate of 2 volts, the dynamo giving 100 volts. The dynamo is the constant-speed machine used in the Megger; the conductivity meter is believed to be a novel instrument, and reads from 0 to 2,000 units, the unit being the reciprocal of one megohm. A thermometer indicates the temperature of the water, for which a correction must be made, with the aid of a table or a simple calculation.

The accuracy of the results obtainable is remarkable, and is exemplified by tests showing the application of the method to determine the hardness of water, the purity of water supply, and the leakage into a surface condenser; boiler priming, river pollution, &c., can also be measured with this apparatus, which will doubtless find many applications in manufacturing processes. Besides an interesting account of the system, the brochure contains much useful information relating to waters and substances dissolved therein. To show the sensitiveness of the method, 10 grains of calcium carbonate per gallon gives a conductivity of 350 units; 20 grains, 650 units; and adding 40 lb. of cooling water to 3,000 lb. of hot-well water more than trebled the conductivity.

"Lux" Candles.

Several improvements have recently been made in the "Lux" electric candles, which are supplied by the Lux Candle Co., Ltd., 240, High Holborn, London. A description appeared in the Elec. Rev. of Jan. 28th and April 1st, 1910, and, as already mentioned, an improvement was embodied in a large order despatched a month or two ago for the Carlton Ritz Hotel, New York, which overcame the difficulty of the bad join, which so often occurs when the holders cannot be sunk in the candle cup. The firm have supplied their metal-filament candles for the new wing in the Savoy. The 'Lux" candles, with 80-watt metal-filament lamps, are also winning their way into country houses through the recommendation of well-known consulting engineers. A special adjustment has been introduced to keep the lamp perfectly straight by means of a rubber washer slipped on the stem of the lamp, thus avoiding the possibility of rattling. In the premises of the Law Society the existing candle fittings have been adapted to the "Adaptation Lux" candle, which does not necessitate any rewiring, as the old candle fittings can be used by inserting the adaptation short lamp which gives the nice transparent effect of the "Lux" candle. The Lux Candle Co. are issuing a new catalogue illustrating the various candles embodying the foregoing improvements, prices being set forth on the last page. For the convenience of contractors and electrical factors generally, the lists can, if desired, be obtained without the makers' name.

Fig. 5.—"Lux" Candle.

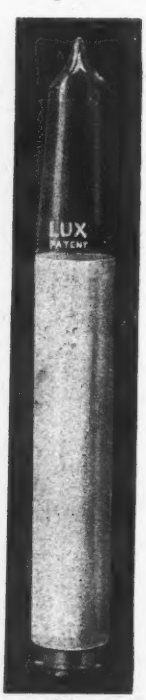


Fig. 6.—Candle Inserted in Cover.

Woodhouse Steel Casing.

Some time ago we referred to this system of light pressed steel casing, which was originally patented by Mr. A. E. Woodhouse some years ago, and has recently been further perfected. The system (figs. 7 to 12) is intended mainly for surface work, and the casing is small in cross-section, and makes a neat job when complete. In erecting the casing, which consists of a trough, with a cover which is sprung on, the troughs are slipped or sprung into close-fitting joint-pieces (clips) which are nailed or screwed to the wall. At the corners and bends a special piece of "bendable" is used. This is merely bent with the hands, without any tools, to the angle or bend required. The wires are simply laid in the troughs, as no drawing-in is necessary. If desired, the wires can be secured in the troughs before the covers are put on, by means of the temporary use of the joint-caps, which are easily pulled off again as they are reached, when the covers are being put on. The covers are sprung over the trough (and clips), the corners of one end being first pushed on. The casing and bends are securely fastened to the wall by the clips, which also provide a slight air-space between the casing and wall. The leg of the tees can be bent forward by hand up to a right angle; this is done with the cover on, and is sometimes very useful.

Fig. 7.—Bendable Casing.

Fig. 8.—Two-way Joint Clip Connector.

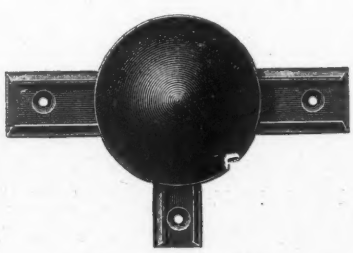


Fig. 9.—Three-way with Cover.

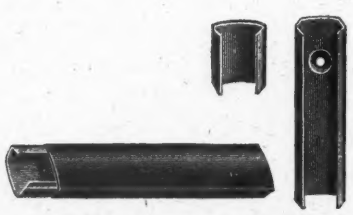


Fig. 10.—Casing and Joint Clip and Cap.

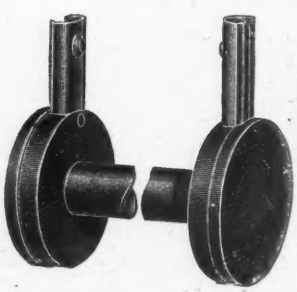


Fig. 11.—Wall Set.

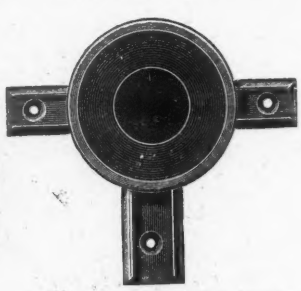


Fig. 12.—Three-way with Rim and Disk.

The casing is easily cut by means of a three-cornered file or fine-toothed hack-saw, as the steel is purposely made thin to follow atmospheric changes quickly, in order to avoid the condensation which is so noticeable with thick piping.

The casing and fittings are either painted with a non-insulating paint, or are sherardised or galvanised. In jointing up painted casing the paint is scraped off by the action of forcing on the springy joint pieces, and hence a good bond is claimed. With galvanised casing a bond is made by the joint pieces, which, it may be pointed out, are always galvanised or sherardised for either painted or galvanised casing, as they are never seen.

The whole of the casing can be quickly taken down, if desired, by removing the covers and wire, and springing out the clip jaws with a tool.

Woodhouse casing is put up with great rapidity, as no bending tools or machine is required, no mitring or fitting or drawing in or threading of wires, and no screwing or nailing on of covers is necessary, hence a great saving of labour is effected. It is shallower than tubing or wood casing, and joists and woodwork do not need to be cut so deeply. We gather that it has the approval of the insurance companies and others.

Sterling Secret-Conversation Telephones.

Referring to our Note last week, the Sterling Telephone Co. ask us to point out that the large installation which we mentioned was not *carried out* by them, as they do not undertake installation work; they supplied the apparatus to one of their clients, who carried out the installation.

BUSINESS NOTES.

London Tube Lighting.—We reproduce here a photograph showing the illumination which is obtained in one of the London Underground Tube Stations by means of a judicious combination of tantalum and "Onewatt" lamps. A number of 100-c.p. lamps with suitable opal reflectors are fixed at regular intervals so that the light is directed upon the platform, whilst tantalum lamps are installed in weatherproof brackets on the wall centrally

Tube Station Lighting.

between them. We understand that tantalum lamps have been running successfully in the trains for some years, some of the lamps having given a life of over 6,000 hours, a remarkable result considering the vibration to which they are naturally subjected. We learn that three further tramway companies have decided in favour of installing tantalum lamps on their cars, and several electric supply companies have arranged street-lighting maintenance contracts with "Onewatt" lamps.

Electric Dredges in the Klondike.—American Vice-Consul G. Carlton Woodward, Dawson, Yukon Territory, reports that one gold mining company is building a 6-mile ditch capable of carrying 20,000 miners' inches of water to supply a power house for furnishing electrical power for dredges which it intends building in the near future. It also intends furnishing power to other dredging companies. Part of the machinery for this plant has already arrived at Dawson, and the balance is on the way. The company contemplates increasing the size of the ditch and adding to the power house in a short time. The machinery and supplies for this power house were principally purchased in the United States.

Dioptric Shades.—As will appear from an advertisement on another page of this issue, Mr. A. P. Trotter desires to procure a specimen of the 12-in. cone dioptric shades (Trotter's patent) which were on the market from 1882 until about 1892.

For Sale.—The Edmonton Guardians have for disposal a quantity of electrical plant and scrap materials. See our advertisement pages in this issue.

"Chris Elco."—An ingeniously devised pamphlet for the popular taste has been issued by Messrs. Cryselco, Ltd., of Bedford, under the title of "Light Notes on a Light Subject." It purports to be the autobiography of "Chris Elco," and is cleverly written, though in an obviously egotistic vein. No doubt the author's self-satisfaction is excusable. It is, perhaps, fortunate that human autobiographers do not dwell so minutely upon the processes

Pump Room: Cryselco, Ltd.

by means of which they came into being as does Mr. Elco, whose life literally hangs upon a thread. Views of the factory are interspersed with the text; we reproduce an illustration of the pump-room in which this vacuous entity is finally born, and is, as he says, "sealed up at the pip." The pamphlet concludes with a price list.

Bankruptcy Proceedings.—W. H. Hunter, plumber and electrician, Towyn.—Receiving order has been discharged in this case, on a composition arrangement of 17s. 6d. in the £, payable as to 5s. now, and 7s. 6d. and 5s. in two further instalments at specified periods.

J. A. Bauer (Electrical and General Engineering Co.), electrical engineer, 17, Gracechurch Street, London, E.C.—November 30th is the last day for receiving proofs for intended dividend. Trustee, Mr. G. E. Corfield, Balfour House, London, E.C.

Liquidations.—"Z" Electric Lamp Syndicate, Ltd.—An adjourned meeting is to be held on December 9th, at Orient House, New Broad Street, E.C., to hear the report of the winding-up from the liquidator, Mr. H. J. Owens.

Leeds Copper Works, Ltd.—A meeting will be held on December 15th to hear an account of the liquidation.

Vitrite Lamp Cap.—Consequent upon proceedings that have been threatened by certain makers of these lamp caps, the General Electric Co., Ltd., Queen Victoria Street, E.C., are issuing a circular to their customers indemnifying them for five years in respect of action for infringement of patent which may be brought against them through the use of any incandescent electric lamps, whether "Osram" or "Robertson," manufactured with vitrite caps, purchased from them.

Hart Switches.—The Hart Manufacturing Co., of Westminster, have recently supplied their switches to the Carlton Hotel, Pall Mall, London.

Staff Social.—The staff of Messrs. Elliott Bros., of Century Works, Lewisham, organised a social gathering at Sangley Hall, Catford, on Saturday last. An enjoyable concert and dance was participated in by over 100 members, and the proceedings terminated with progressive whist.

Fire.—According to the newspaper Press, a fire that occurred at the works of Messrs. Vickers, Sons & Maxim, at Sheffield, on 9th inst., destroyed a quantity of electrical machinery.

Australia.—According to the *Board of Trade Journal*, the Imperial Trade correspondent at Brisbane reports that a firm there desires to obtain the representation of British manufacturers of hardware, electrical goods, tools, &c. For name, apply to Board of Trade, C.I. Department, 73, Basinghall Street, London, E.C.

Rubber Prices.—The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silvertown, announce that, owing to the fall in the market price of rubber, they have made, from 5th inst., further reductions in the price of their rubber insulated wires and cables. The discounts on their October, 1910 (No. 40), price list are, therefore, altered.

Buenos Ayres Exhibition.—Messrs. Pirelli, Ltd., have been awarded the Grand Prix for their wires and cables by the International Jury of this Exhibition.

Catalogues and Lists.—THE LIVERPOOL ELECTRIC CABLE CO., LTD., Vauxhall Road, Liverpool.—Eight-page pamphlet (October 24th), giving tabulated sizes, weights and prices of "Association" 300, 600 and 2,500 megohm-grade wires and cables, and "Non-Association" 600-megohm quality.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Leaflet No. S1,442 (November), giving prices of Osram lamps for various voltages and candle powers, also lamps for candle fittings. Another novelty which doubtless will be acceptable to many contractors and suppliers is a "Glacier" adhesive transparent show label, consisting of a small edition of the Osram show-card recently issued, which should be effective when affixed to glass windows and doors—even with a "gas-jet" behind. But why that gas-jet?

THE PHOSPHOR BRONZE CO., LTD., 87, Sumner Street, London, S.E.—New catalogue (48 pages) giving particulars of their phosphor bronze, its general properties, treatment, tenacity, casting alloys, phosphor tin, manganese and aluminium bronze, white metals, Babbitt's metal, Magnolia metal, and so forth. Several pages contain tabulated weights of various rolled metals in pounds per lineal foot.

MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—A new leaflet giving illustrations and prices of a number of their new designs of "Spookie" shades for the season. We understand that these are more strongly made than heretofore, while by the use of a special new form of linen paper, richness in colouring effect has been added. All new "Spookie" shades have the

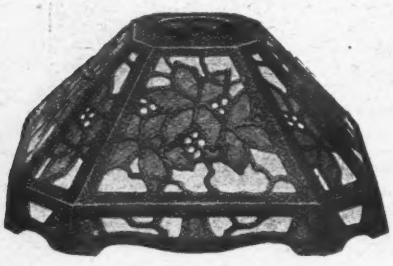


FIG. 1.

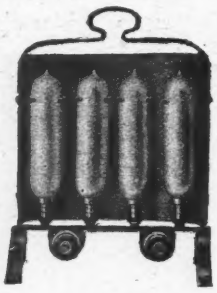


FIG. 2.

metalloid framing, which is made in three finishes, namely, brown or antique, green, and silver framing. We illustrate the "Woodbine" pattern (fig. 1). A small eight-page pamphlet of electric radiators with neat illustrations of luminous and convector patterns has also been issued. A cheap four-lamp line is shown in fig. 2. It is made in black iron with polished brass reflector.

THE HART ACCUMULATOR CO., LTD., Stratford, London.—Abridged price leaflet of ignition batteries.

THE CENTURY ELECTRIC CO., St. Louis, U.S.A.—Forty-eight-page catalogue (No. 14) giving numerous illustrations of, and a good deal of information relating to, the "Century" single-phase motors. The illustrations show the motors at work driving a variety of small machines.

THE SILENT ELECTRIC CLOCK CO., 192, Goswell Road, London, E.C.—Pocket catalogue of 28 pages, giving many illustrations of their "Silent" electric clocks and parts thereof, with particulars and prices.

MESSRS. MAVOR & COULSON, LTD., Glasgow.—Large hanging show-sheet of their various electric power plant.

Book Notices.—"*Journal* of the American Society of Mechanical Engineers." Vol. 32, No. 11. November, 1910. New York: The Society.

"*Journal* of the Franklin Institute." Vol. CLXX, No. 5. November, 1910. New York: The Franklin Institute. Price 50 c.

"Mechanical Engineering for Beginners." By R. S. M'Laren. London: Charles Griffin & Co. Price 5s. net.

"Fire Tests with Automatic Fire Alarm Systems: The Aero Fire Alarm." 1910. London: The British Fire Prevention Committee. Price 2s. 6d.

Trade Announcements.—MESSRS. BURN & CO., LTD., of Howrah, have been appointed agents in India for Messrs. C. A. Parsons & Co., of Newcastle-on-Tyne, for turbine, electrical, condensing and other plant, and according to the *Indian and Eastern Engineer*, Messrs. Parsons are sending out their own resident engineer to handle matters.

MR. H. DUNFORD SMITH, analytical chemist, announces the removal of his laboratory and assay offices to 7 and 9, The Side, Newcastle-on-Tyne.

On an illustrated publicity card of their A.E.G. flame arc lamp, the A.E.G. ELECTRIC CO., LTD., give, on the reverse side, a list of their London and provincial addresses.

THE CENTRAL AND SOUTH AMERICAN TELEGRAPH CO., of New York, advise that all cables to that company in connection with orders, shipments, freight rates, estimates and other matters pertaining to the purchasing department, should be addressed "Csatelegco," New York. The A.B.C. code fifth edition is used.

THE SLOAN ELECTRICAL CO., LTD., are removing to-morrow, Saturday, to Conradty House, 12, Golden Lane, London, E.C.

MESSRS. MONCRIEFF P. FORD & CO. have opened offices at 57, Colmore Row, Birmingham, where they will carry on business in engineers' small tools and hardening furnaces, gauges of all kinds, pyrometers, &c. Mr. Moncrieff Ford was recently sales manager to Mr. S. N. Brayshaw, of Manchester, and previously managing director to the Brooke Tool Manufacturing Co., of Birmingham.

Consular Notes.—Bavaria.—The British Consul at Nuremburg, in a recent report, states that although Bavaria represents about one-tenth of the total population of Germany, it has at its disposal only one-two-hundredth part of the total output of coal in the Empire. Therefore it is easily understood that it is of considerable importance for Bavaria to find an equivalent for the coal with which nature has not enriched the country, by the utilisation of the existing extensive water power. This question has been raised during recent years and is being amply discussed. As to practical realisation, it is still but a pending question, although it would be of great advantage to Bavaria to be able to avoid having to purchase coal at high prices. The Bavarians will have to face certain obstacles in the execution of this, the most important economical task of the present. The Government Statistical Office recently instituted inquiries relative to the existing works for generating electricity. According to the preliminary results of the inquiry, 2,386 electricity stations were in existence in Bavaria. This figure includes also plant for generating current for private requirements only. After completion of the final inquiry, the number of stations may possibly be about 2,500. The greatest number of works (1,620, or 67·9 per cent.) are the property of private individuals, and there are 374 works, or 15·7 per cent., belonging to the limited liability companies, including partnership concerns. The remainder are owned by the Government, by communities, and by co-operative societies. The power is generated by water, steam and other engines, in some instances by one of these only, in others by a combination. They represent altogether, including reserve motors, an effective power of 275,472 KW. Machines are at work generating electrical power of a total of 190,414 KW. Nearly half of the total power (128,536 KW., or 46·7 per cent.) is supplied by steam engines without any other reserve power. By the sole use of water power less than one-tenth of the total produce is gained. Water and steam participate with three-tenths (80,724 KW., or 29·30 per cent.), in which steam is used, as a rule, only in case of necessity. The power produced by gas, benzine, spirit and petroleum engines is comparatively insignificant (10,603 KW., or 3·9 per cent.).

Sand Fire Extinguishing Equipment.—A sand fire extinguishing equipment has recently been supplied by MESSRS. MERRYWEATHER & SONS, of Greenwich, to a prominent London electric light company for the protection of their power station. It comprises a three-wheeled sand truck, constructed of stout galvanised sheet steel, and holding about 6 cwt. of sand. The sand can be taken from the top, hinged covers being provided to open from either end, or it can be shovelled into a bucket from the side, in which a sliding panel is fitted. When the sliding panel is raised, a peg is inserted in a hole in the side of the truck to prevent the panel from dropping down. A fibre bucket is carried on a bracket at the back, and two strong wooden spades are supported on suitable iron brackets at the side. In another form, the sand bin is of larger capacity (holding about 8 cwt. of sand), and is mounted on legs instead of wheels. It is equipped with two fibre buckets and two spades, and has a hinged cover at the top and a sliding panel at the side. An equipment of this kind is strongly recommended for all premises where electrical power is utilised, as well as for motor garages, motor-car works, petrol and oil stores, electric theatres, &c.

International Exhibiting.—We understand that a large number of applications has been received for space in the British Industrial Court at the Turin Exhibition. The German Press has been speaking in emphatic terms of the great advantage which the magnificent display made by the chemical manufacturers of Great Britain at Brussels has given us in the markets of the world. The Chemical Industries Committee of the British Royal Commission is already considering how the recently-organised Chemical Court which attracted so much attention at the Brussels Exhibition may be improved. As we have shown in our pages at different times, American manufacturers of machinery and machine tools have been urged by their Consuls to take full advantage of the increasing opportunities of trade in Italy. It is therefore evident that British manufacturers must be quite alert in regard to this Exhibition. At the meeting of the Association of Chambers of Commerce of the United Kingdom it was resolved that "in view of the success which has attended the collective exhibits of the Chambers of Commerce at the Brussels Exhibition and their effectiveness in directing attention to the staple industries of this country, the Association strongly recommends all the Chambers representing manufacturing industries to organise collective displays of their products in addition to the industrial exhibits of their members for the Turin Exhibition to be held next year." We have little doubt that our firms will avail themselves of the assistance that is being rendered by the Exhibitions Branch of the Board of Trade in such matters.

Electrical Concessions in Turkey.—A peculiar contrast exists between electrical enterprise in the Turkish capital and in the provinces, if we are to believe the Constantinople correspondent of the *Berliner Tageblatt*, who has forwarded a remarkable story which appears incredible, although the recent circumstances surrounding Turkish action in regard to the Mahsousseh steamship concession cannot be omitted from consideration in this connection. The correspondent states that the issue of the electrical concessions

for Constantinople does not make any progress. The Buda-Pesth firm of Ganz & Co. already believed that it safely had the concession for electric lighting, but the affair is still not definitely decided; and a Swiss syndicate is making the greatest efforts to obtain the concession. No tangible form, it is declared, has also been assumed by the telephone concession. It was certainly awarded to an Anglo-French-American syndicate, but this grant was contested, and Constantinople still waits for the telephone. It is not known in the Turkish capital whether a concession has been definitely allotted until the work of execution is begun. The local tramways company hopes soon to receive permission to introduce electrical working, and is consequently reconstructing all its lines which, together with the street works associated with the work of relaying, is causing considerable expenditure. If the account thus given is correct, it will be right to conclude that the lighting concession is being contested by the Union Ottomane which represents German, Swiss and French interests, and which entertained almost certain hopes of receiving the concession, whilst the opponents of the telephone concession as awarded can only be German interests, assuming that the story is well founded also in this respect.

If reference is now made to the Turkish provinces, it is found that electricity is making constant progress. Arc and glow lamps are already in use at Damascus, Beyrout and Salonika. During the past summer a German firm introduced electric lighting at Konia without any concession and long negotiations, simply because the Vali is an intelligent and enterprising man! Electricity is now also to find admission into Jerusalem, where, as we stated in the Electrical Review, October 28th, page 704, a number of schemes have been open to tender.

Olympia, 1912.—We have received an advance circular concerning an International Engineering and Machinery Exhibition which the *Engineering Review* is promoting, to be held at Olympia in October, 1912.

D.P. Batteries.—During the past month the "D.P." Battery Co., Ltd., shipped batteries to the Transvaal (two), India, Siam, Queensland, Newfoundland and Canada. For the home trade they have received an order for the complete re-plating of another make of battery at the Charlotte Street sub-station of the Chelsea Electric Supply Co.

Press-spahn.—The high insulating properties, mechanical strength and cheapness of press-spahn render it one of the most useful materials in electrical manufacturing. It stands well in hot oil, enduring a temperature of 80° to 100° C. for an indefinite period. Messrs. J. H. Weidmann, of Rapperswil, Switzerland, who make a speciality of the manufacture of press-spahn for insulating purposes, have given special attention to rendering the material non-hygroscopic, and the surface, on which so much depends, of high insulating efficiency. Their 0·25 mm. sheet tested at the Reichsanstalt withstood a testing pressure up to 3,000 volts, a result claimed as a record. It is made in sheet, rolls (up to 200 m.) and ribbon of various widths and thicknesses, and may be had combined with mica, oiled or paraffined. It is also made up into tubes, troughs, &c., for special purposes. A variety of other insulating materials, such as micanite, cornit, &c., is also made by the firm.

LIGHTING and POWER NOTES.

Argentina.—Work has commenced on the new power house at Sorrento, of the Rosario Electric Light Co. It will have a capacity of 10,000 H.P. and will be equipped with steam turbines.

The hydro-electric power house at Jujuy, property of Messrs. Alvina and Pitto, has been purchased by Mr. C. Seguin for $60,000.

Australia.—Concern is being felt in Sydney at the action of various suburban councils who are either making or disposed to make contracts with the Balmain Electric Light Co. for municipal services in preference to getting their supplies of current from the Sydney City Corporation. The Lord Mayor is under the impression that jealousy of the Sydney Corporation has a great deal to do with the dealing with the Balmain Co. The Mayor of Newtown, on the other hand, puts it that there is reason to dread the establishment of an electric light and power supply monopoly if the Sydney Council is too generally dealt with, and he admits that that consideration weighed with his aldermen in dealing elsewhere.—*Australian Mining Standard.*

The Zeehan municipality is installing a number of 200-C.P. Welsbach metal-filament lamps for street lighting.

According to the *Australian Mining and Engineering Review*, among those who are proposing, or inviting tenders for, electric supply schemes are the Ararat B.C., the Europa, Narrawonga, Wodonga, and Traralgon Shire Councils, the Albury, Inverell, and Henty (N.S.W.) municipalities.

The municipalities of Brunswick, Coburg, Northcote, Preston, and Broad Meadows (Vic.), northern suburbs of Melbourne, are obtaining estimates for the erection of a power-house and the lighting of the suburbs mentioned. Alternatively, the City Council is to be asked its terms for a supply.

The new waterside power plant of the Brisbane City E.L. Co. is under construction, provision for 700 and 500-KW. turbine sets being made. The Melbourne City Council is substituting 50-C.P. metal-filament lamps for a large number of 32-C.P. carbon street lamps.

Ballymoney (Co. Antrim).—The U.D.C. is presently interested in an electric lighting scheme for the town, and is in correspondence with an electrical firm towards that object.

Barnes.—The electrical engineer reports that to meet the demand for the winter, 1911, it will be necessary to further extend the generating capacity of the works. He suggested that a unit of 600-750 KW. capacity, together with boiler house and auxiliary plant, be installed. It would also be essential for further office accommodation to be provided. A detailed scheme with plants, specifications, and estimates is to be prepared. The Council at its last meeting adopted a recommendation to the effect that further sums be added to the investment reserve fund until the whole fund amounts to £10 per cent. of the aggregate capital expenditure on the undertaking.

Birkenhead.—Mr. H. R. Hooper, L.G.B. inspector, held an inquiry on November 9th, relative to the T.C.'s application for sanction to borrow £2,000 for a steam turbine with direct-current generator, for the Bentick Street power station. The inquiry, which has been necessitated by certain rearrangements of the electric service, was adjourned for the production of additional information which the Inspector desired.

Bognor.—The U.D.C. on Friday last decided, by six votes to one, to apply for a prov. order for E.L., and to purchase provisionally for £525, a site for a generating station.

Bradford.—Mr. T. Pratt introduced the question of municipal trading at a meeting of the Council of the Bradford Chamber of Trade held on Monday, November 14th, and stated that recently a new association had been formed in Bradford to protect the interests of the electrical engineers of the city. The Bradford Corporation had lately taken up another form of trading, which competed with the electrical engineers of the city, by establishing a showroom of electrical fittings at the Town Hall. Originally it was intended that this should be merely a showroom, but the officials at the Town Hall were selling large quantities of goods which could be bought at the shops of electrical engineers in the city. Mr. Pratt moved that the Chamber should support the Electrical Contractors' Association in every possible way to put a stop to the selling of electrical fittings from the Corporation's showroom. This was seconded and carried unanimously.

Bromley (Kent).—The T.C. has consented to private traders in High Street erecting overhead wires for arc lamps in order to improve the lighting of the thoroughfare for business purposes. The wires are to be 30 ft., and the bottom of the lamps at least 28 ft., above the road.

Castleford.—The U.D.C. has received from Mr. C. J. Jewell, of Wakefield, a report on the cost of street lighting by electricity, for which current is offered by the Yorkshire Electric Power Co. at 1d. per unit. He states that the cost of cables and of fitting lamps is excessive, and skilled labour would be necessary; therefore he cannot recommend the proposal. For lighting 469 posts, the cost of cable would be £7,110, and connecting up and converting the lamps would cost £1,149, while current, cleaning, renewals and yearly charges on loan would amount to £1,349, or £2 17s. 6d. per lamp per annum. The lighting of 63 lamps where cables are laid would cost £2 5s. 7d. per lamp per annum. The Council will not adopt the first-named scheme, but has asked for terms on the lines of the lesser scheme from the Power Co.

Clayton-le-Moors.—An agreement has been entered into between the Accrington Corporation and the U.D.C. for the supply of electricity to Clayton, at what is stated to be practically cost price.

Continental Note.—France.—A new steam turbine and alternator of a capacity of 6,000 KW. is being installed at the central station of the Société d'Energie Electrique du Nord de la France, at Roubaix.

Dromore (County Down).—The R.D.C. has approved of a plan for the lighting of the town by electricity. The scheme, which has been formulated by Messrs. Wilson, Miller & Pegg, Belfast, contemplates the installation of two 20-KW. generators, overhead mains, &c., at a cost of £3,998.

Ealing.—Application is to be made to the L.G.B. for sanction to the raising of £15,000 for extension of mains and services, and £5,000 for meters. At the last meeting of the Council the matter of a free supply of electricity between certain hours, to those tradesmen illuminating their premises in connection with a shopping week, was discussed.

Eccles.—The profit made by the Electricity Committee during the past year is £1,216, as against £860 in the previous year.

Enniskillen.—The U.D.C. is considering the advisability of granting permission to a company to promote an electric lighting scheme for the town.

Falkirk.—The Lighting Committee has asked the electrical engineer to report as to the cost of lighting Main Street, Camelon, by electricity.

Glasgow.—An interesting report by Mr. Lackie, the electrical engineer to the T.C., has been approved by the responsible committee of the Corporation. The report dealt with supply to domestic consumers with energy for cooking, heating and other domestic uses, at a lower rate than the charge for lighting—the energy so used to be taken from the existing lighting circuits, thus avoiding the cost of extra wiring. He was of opinion that there would be no difficulty in meeting the case by a method of charging which was an adaptation of the maximum-demand system. From an examination of a large number of accounts of domestic consumers covering the past three years, he found that these accounts were practically stable from year to year, and even in the corresponding two-monthly account periods of different years. The examination showed that the maximum-demand quantity of domestic consumers, averaged an 800 hours' use of the maximum-demand per annum. The present charge to domestic consumers was a flat rate of 3d. per unit, and he suggested that they charge a maximum-demand rate of 3d. per unit for 800 hours' use of the maximum demand, all current consumed over this quantity to be charged at 1d. per unit. Further, he proposed that the initial charge for the first 800 hours' use of the maximum demand should be on the principle of a proportionate number of 3d. units in each two-monthly account period, all the units consumed over this fixed quantity in the period being charged at 1d. This system of charging would increase the output and add to the revenue without adding to the expenditure in the way of branch mains, fuses, meters and meter readers, or expenses in administration. He believed it would lead to a considerble use of electricity for intermittent heating in spring, summer and autumn, when fires were generally off and only occasional heating was required. This was the time of the year when they had a considerable amount of plant standing idle, earning no revenue, so that heating units at 1d. would be profitable revenue.

The T.C.'s Electricity Sub-Committee on Works is to consider a report upon a proposal for a joint exhibit by the Corporation and manufacturers of electrical appliances and electrical contractors, at the Scottish Exhibition of National History, Industry, &c., to be held in Glasgow next year.

Cheques for £21,566, being costs and expenses for ground acquired (in the east end of the city) by the T.C. recently for a new electricity generating station, have been signed.

Golborne.—In reply to a query from the B. of T. as to whether anything is being done to carry out the E.L. order, 1905, the U.D.C. has replied that it is in negotiation with the Lancashire Electric Power Co. as to the disposal or the utilisation of the order.

Hastings.—As the result of long consideration, the Guardians of the Hastings Union at their last meeting decided, by 14 votes to 6, to substitute electric lighting for gas at the workhouse and infirmary buildings. The Corporation Electricity Committee is co-operating with the Guardians in the matter, and will lay the necessary mains. En route the Corporation will be able to install the electric light at the borough sanatorium, and a number of gas lamps can be transformed. A report presented to the Guardians showed that at the present time the average cost of gas at the workhouse amounted to £282 10s. a year, and it was predicted that the adoption of electricity would mean a saving of £57 10s. a year, after allowing an expenditure of £15 for gas for the cooking stoves. It is proposed that alternative tenders be obtained for the ordinary cased-in system and the "O.S." system. Altogether 486 lights will be required, and the total cost of the installation is estimated at from £400 to £460.

The T.C. is applying to the L.G.B for sanction to the borrowing of £2,083 for prospective capital expenditure on new mains.

Hipperholme.—The Yorkshire Electric Power Co. has commenced the laying of mains in the district, and current will be available within three weeks.

Japan.—The large Tokyo Denko Kaisha, the electric power station of Tokyo, has adopted 60,000 volts pressure for the transmission of electric current from the central to the transformer stations, where it is reduced to 12,000 volts. The concern has recently placed an order for some 85 miles of different cables, weighing 2,150 tons, with a German firm, the delivery to take place next spring.

Limerick.—On Thursday last week, a meeting of the E.L. Committee was held to arrange the terms of the appointment of a successor to Mr. P. T. McNamara, the electrical engineer who recently resigned. As usual a highly entertaining discussion took place, this time on the matter of salary allowance, &c., to the retiring engineer. The new appointment is to be at £200 with a maximum of £300 per annum, and acquaintance with the "Irish" language and history will be a recommendation. Possibly an advertisement in Gaelic would fetch a suitable applicant.

London. — BERMONDSEY. — The Finance Committee has again reported as to the proposed provisional order for the St. Olave district. The electrical engineer informed the Committee that his estimate of laying the mains in the compulsory area was £8,250. The Electricity Committee reports that the L.C.C. lodged an objection against the assessment by the Valuation Committee of the electricity undertaking, *i.e.*, £3,399 gross, and £2,266 rateable, the County Council suggesting that the correct figures would be £8,000 gross, and £3,000 rateable. The present figures are £2,693 gross, and £1,766 rateable. The objection was heard with the result that the Assessment Committee increased the figures to £4,108 gross, and £2,739 rateable. The Committee considers this increase unfair and incorrect, and had, therefore, decided to object to the valuation list on redeposit.

ISLINGTON.—The Lighting Committee reports having received an application from the Corporation of the City of London, for a supply of electricity for lighting and power purposes to the Metropolitan Cattle Market, Caledonian Road. The necessary main is to be laid at a cost of £100.

MARYLEBONE.—The Lighting Committee reports that during the past fortnight 89 lamps have been converted from gas to electricity, and three new lamps have been fixed, making a total of 3,459 public street lamps now lit by electricity.

WOOLWICH.—At the last meeting of the Borough Council it was reported that, in connection with the negotiations with the West Ham Corporation as to supplying energy to the Port of London Authority in the Royal Albert Docks, it was stipulated that the West Ham authority should agree to give Woolwich a supply in bulk, if required, upon terms to be arranged between the respective electrical engineers. Further negotiations have been proceeding since, and West Ham had undertaken to execute an agreement to give a bulk supply.

Lydney.—The R.D.C. has decided to adhere to its recent decision that 6d. per unit should be the maximum price for energy to be charged by the Chepstow Electric Power Co. The latter is prepared to supply energy at 6d. per unit, but objects to that price being made the maximum instead of 7d.

Manchester.—The application of the City Council for sanction to borrow £30,000 for electricity purposes was the subject of an inquiry at the Town Hall on Friday last, by Mr. A. G. Drury, on behalf of the L.G.B. The loan is required for the provision of a turbo-alternator at the Stuart Street electricity station, &c., and forms part of a sum of £130,500, which the Council decided in 1908 to borrow in connection with the electricity undertaking, and of which £88,314 has already been sanctioned. Mr. Percy, vice-president of the Manchester Ratepayers' Association, submitted that the policy of the Electricity Committee in supplying electricity to large firms at a specially low rate, in not allowing more for depreciation and reserve, and in not charging the Tramways Committee more than cost price, was at fault. In quoting the statement of the chairman of the Gas Committee that the electricity department "was slowly murdering the gas department," Mr. Percy contended that there should be equality of treatment of both departments, and referred to the difference in their contributions towards the relief of the rates. Mr. S. L. Pearce, chief engineer of the electricity department, replying to questions, said the question of policy was a matter for the City Council to decide. With regard to the fall in revenue in 1908, Mr. Pearce spoke of the effect which the introduction of metal-filament lamps created. He emphatically denied that they were selling electricity at less than cost price, but admitted that no profit was made on the sale of energy for tramway purposes. Alderman Gibson, chairman of the gas department, called by the Ratepayers' Association, expressed his disagreement with the policy of the Gas Committee in subsidising the rates, and thought that as both the gas department and electricity department were under the Corporation, they should be treated alike. The Inspector will present his report to the department, whose decision will be forwarded in due course.

Mexico.—The *Mexican Herald* contains some particulars of a large power scheme, covering an area 1,200 miles × 150-200 miles, and embracing the construction of three hydro-electric plants to give 300,000 H.P. The scheme covers some 20 cities and towns on the west coast, and in addition to industrial uses, the supply of energy to the Southern Pacific Railway for traction, contracts for which are said to have been signed.

Newcastle-under-Lyme.—The T.C. has decided to supply energy at 7d. per unit with a discount of 1d. per unit if accounts are paid within 28 days. Hitherto the net price has been 6d. per unit.

New Zealand.—According to the *Australian Mining Standard* it is proposed to hold at Palmerston a Conference of Chambers of Commerce interested to consider a scheme for harnessing Lake Waikaremoana to obtain electric power for lighting purposes.

The Parliamentary Works statement shows expenditure on public works for the current year amounting to over £3,000,000. This includes £300,000 on the development of water-power and £140,000 on telegraphs. In connection with power development it is proposed to start with Lake Coleridge, where 10,000 H.P. could be obtained for transmission to Christchurch, 70 miles away. It is also proposed to supply Wellington with power from Hutt River, and Auckland with power from the Huka Falls or Kaituma, and the early electrification of the suburban railways is hinted at.

Norwich.—The T.C. has entered into an agreement with the Norwich Electric Tramways Co. for the use of the tramway poles for overhead wires for street lighting at a rental of 1s. per pole per annum.

Northwich.—In view of the termination of the contract with the Gas Co. for street lighting, the U.D.C. has consented to an interview with the secretary of the Electric Supply Co. on the question of electric lighting.

Perth.—The Corporation electrical engineer recommends that two of the four boilers be supplied with stoking plant at an estimated cost of £150 per boiler, with a view to reducing smoke nuisance.

St. Albans.—It was announced at the last meeting of the R.D.C. that a firm had secured a site at Fleetville for the establishment of an electrically-equipped scientific laboratory. The electric power necessary for the laboratory is available, and the R.D.C. has decided to give facilities to the firm, the name of which has not yet been divulged.

Southampton.—The electrical engineer has reported upon the lighting in Lower High Street. Above Holy Rood they had centre lighting, which was admittedly the best system to adopt, but it was not possible to have centre lighting in the Lower High Street. It was only possible to increase the lighting by the adoption of higher candle-power lamps. With regard to the altitude of the lamps, it was interesting to notice that when new public lighting was installed in other towns the tendency was always to increase the height of the lamps. The South-Western Railway Co., in all their recent lighting in Southampton and elsewhere, had adopted a 50-ft. pole, the result being a uniform distribution of light and the illumination of dark patches between the lamps. As regards the other towns, the average distance of arc lamps from each other is anything between 40 and 60 yards, and for incandescent lighting 30 or 40 yards. In Glasgow he noticed that streets were lit with lamps on either side of the roadway at approximately 25 yards apart. Lower candle-power lamps were used, and the thoroughfare was well lit but at a higher cost. The consideration of the report has been adjourned. The electrical engineer has been requested to prepare a report as to the cost of lighting East Park.

Southport.—It is announced by the borough treasurer that the borrowing powers on the electricity account are practically exhausted. The electrical engineer estimates that during the next three years it will be necessary to expend on capital account £12,000; mains and services at £3,000 per annum—£9,000; ten sets of series gears, £760; 12 transformers, £576; six switch pillars, £300. Contingencies are estimated at £1,364. The Council has agreed to apply to the L.G.B. for sanction to the borrowing of the necessary sum for extensions to the mains, &c.

Stalybridge.—The Electricity Board has decided to supply current to the mills of the Victor Mill Co.

Sunderland.—A Sub-Committee of the Electricity Committee of the Corporation is at present considering a report on new methods of charging for electricity. The idea is to make a fixed charge per annum to cover the capital charges, and a low charge per unit to cover works costs. Three alternative schemes have been submitted.

Twickenham.—Under the E.L. Order, 1900, the Electric Supply Co. has applied to the B. of T. for consent to use overhead lines for the supply of current at a pressure of 460 volts from the works at Twickenham, to the premises of the Fulham Joinery Works.

Watford.—The U.D.C. has decided to give moral support, but not financial aid, in the promotion of a Bill by the I.M.E.A., to secure powers for local authorities to deal in fittings, and to undertake wiring work.

Whitworth.—The Works Sub-committee of the Rochdale T.C. reported to the Electricity Committee in regard to the supply of electricity to Whitworth Council, that it was not prepared to take over the responsibilities imposed by the provisional order granted to the U.D.C., but was quite willing to supply current in bulk on terms to be arranged, and to this the full committee agreed.

TRAMWAY and RAILWAY NOTES.

Argentina.—A concession for electric tramways in the City of Salta has been granted to Mr. E. Barré.

The Compania Electrica del Norte has applied to the Government of Santiago del Estero for a concession for electric tramways in that city.

Australia.—In view of the steps being taken to amend the Tramway Act, South Australia, giving the Adelaide Municipal Tramways Trust power to sell electricity to the municipalities, the Adelaide City Council appointed a committee to consider the question of a municipal electric supply. A report has been submitted by this committee, wherein the Council is urged to enter into negotiations for the purchase from the Adelaide Electric Supply Co. of its undertakings. Under the Electric Lighting Co.'s Act, the Corporation has power to acquire such installations.—*Australian Mining and Engineering Review.*

Barton-on-Humber.—The Barton and Immingham Light Railway Co. has applied to the Light Railway Commissioners for an extension of time for carrying out the works scheduled in the order.

Belfast.—A special meeting of the Tramways and Electricity Committee was held on Monday, for the purpose of considering the suggestions of the general manager as to the working of the Glengormley tramway when taken over by the Council. It was arranged that the line should be doubled from Chichester Park to a point about 8 chains beyond the entrance to the present depôt at Whitewell, and that the work be carried out by the surveyor's staff. The existing line was ordered to be connected with the city lines as soon as the Corporation obtains possession. The general manager submitted a scheme for the discontinuance of Bellevue pleasure gardens, and for the establishment of a new pleasure ground on the land adjoining the Cavehill and Whitewell Co.'s existing depôt, at present the property of the company. The proposal is to develop this ground, which is about 38 acres in extent, and open cafés and amusements. A sub-committee was appointed to consider the suggestion and report at a later date.

Chile.—The Minister of Public Works has been asked to give preferential treatment to the Bill for the electrification of the Santiago and Valparaiso railway, and of the Andes branch line.

Continental Notes.—ITALY.—The Società Imprese Elettriche Piacentine has obtained a concession for the construction and working of a new standard gauge electric tramway in Piacenza from Piazza San Savino to Molino degli Orti.

SWITZERLAND.—A concession has been granted to the Société de Développement de St. Moritz for an electric funicular railway from St. Moritz to l'Alpe Giop. The line will cost £16,800.

A concession is also granted to the Società delle Tramvie Elettriche Locarnesi for an electric railway from Gordola to Bellinzona. The line will be about 8 miles in length, and the cost of construction is estimated at £39,680.—*Board of Trade Journal.*

BELGIUM.—The municipal authorities of Ghent have granted a concession to the local tramway company for the construction of a new electric tramway line between the railway stations of Gand-Sud and Gand-Saint Pierre.

Dartford.—The U.D.C. has decided to supply current for five years to Messrs. Balfour, Beatty & Co., Ltd., for the tramways: First 100,000 units per annum, 1½d. per unit; from 100,000 to 250,000, 1¼d.; from 250,000 to 400,000, 1¼d.; beyond, 1d. This is provided that the firm undertakes to promote in the next session of Parliament a Bill or Provisional Order for the construction of the connecting link between Horns Cross and the Gravesend system, and to construct the line immediately the powers are obtained.

Doncaster.—It is proposed to extend the tramways in the direction of Arksey in order to meet the rapidly growing needs of the district through the development of Bentley colliery.

Dunfermline.—A deputation from the T.C. has had an interview with Mr. Balfour, of the Dunfermline and District Tramways Co., pressing on him the desirability of extending the system to Rosyth in the near future.

Dunoon.—The T.C. has granted wayleave to a company which proposes to establish a service of tramcars between Dunoon and Sandbank. The company's proposal is that the line should start at the Victoria Bridge, West Bay, and run along the East Bay Esplanade to Sandbank, *viâ* Kirn and Hunter's Quay, with a branch line along Argyll Street to the Recreation Park. The company is prepared to provide the power or take it from the Council, who, in the latter case, would require to erect suitable works for the purpose of generating electricity. A provisional order will be necessary, and the whole of the work is to be completed in two years.

At a private meeting of the T.C. alternative schemes submitted by the company in connection with the tramway service were discussed. The company offered to provide power itself, and in view of the expense of erecting suitable plant the offer was accepted. A protest has been received from residents of Kirn and Hunter's Quay, against the service of tramways along the shore road which traverses those places.

Irlam.—Officials of the Irlam and Cadishead D.C. have had an interview with the Salford Tramways Committee respecting the proposed extension of the Salford tramways to the Irlam and Cadishead districts, which promise to develop into important industrial localities.

Japan.—The Japanese Railway Board has decided to lay down a narrow gauge electric tramway alongside the railway track from Yokohama to Tokio. This tramway may subsequently be extended to Kozu and Kamakura.—*Board of Trade Journal.*

Northampton.—The borough surveyor has been instructed to prepare plans and sections for extensions of the tramways to the borough boundaries on the Kettering, Towcester and Weedon Roads.

Paraguay.—The Central Paraguay Railway Co. has presented a project for a concession for an electric tramway and power station, and motor-car service, improving on the conditions of that presented by Senor Carosio. Reductions are offered in freights, passages, and in price of electric power, and the company contracts to commence work 30 days after the plans are approved; 12 km. of the lines will be opened to the public, and the power station completed, within 18 months of the signing of the concession.

Quarry Bank.—The U.D.C.'s at Rowley Regis, Brierley Hill and Quarry Bank have decided to apply to the B. of T. for an extension of the Light Railways Order pending the completion of the negotiations for the disposal of the order.

Skipton.—The R.D.C. has under consideration a suggestion of the Keighley Corporation to invade the Skipton district with a system of trackless trolley cars. The district affected is in the neighbourhood of Crosshills and Kildwick, where there is a service of motor-'buses, as far as Cowling. The nearest

railway communication for which is at Kildwick, 3 miles distant. There promises to be some opposition from the neighbourhood, and if there is any possibility of Cowling being again isolated, the Skipton R.D.C. might feel it incumbent upon it to apply to Parliament for the same powers as are now contemplated by the Keighley Corporation.

Tottenham.—The Metropolitan Electric Tramways, Ltd., states that, at the request of the Essex C.C., it is applying to Parliament in the coming session for power to rebuild the bridge carrying Ferry Lane over the River Lea, and that until the bridge is rebuilt, no through communication by tramways between Tottenham and Walthamstow is possible. The company will insert in the Bill a clause authorising the transfer of the Tottenham-Walthamstow Light Railway Order, 1906, to the Middlesex C.C., with a view to incorporating the tramways thereby authorised in the general system of the Middlesex Tramways owned by the County Council, but worked under lease by the company. The Urban Council has agreed to assent to the proposed transfer, subject to protective conditions.

U.S.A.—The Central Park, N. & E. River Railway Co., which has been operating horse cars in New York city on a number of its lines, has decided to install Edison battery cars on its West Street route. There are at present 100 miles of horse-car lines in the Borough of Manhattan, and it is believed, says the *Electrical World*, that these will be all operated by battery cars within a year. A two-truck battery car, equipped with four 85-volt 40-ampere motors is being put into service by the South Shore Traction Co.

West Hartlepool.—The T.C. has decided to go forward with its scheme to purchase the Park and Foggy Furze routes of the tramways from the present company. Notice of the T.C.'s intention to purchase was given some months ago, and the company put the price as £22,000. The Council, it is understood, offered £14,000. Negotiations then ensued as to the company renewing the lease, and the latter body demanded a 42-years' term, as the alternative to purchase. This, the Corporation decided, was too long, and consequently, arbitration to fix the price will be proceeded with.

TELEGRAPH and TELEPHONE NOTES.

Wireless Telegraphy.—On November 13th Mr. Marconi received telegrams from the wireless stations in Canada and at Massowah, at the Coltano station in Italy, in the presence of the King and representatives of the Italian Government.

It is proposed to erect additional wireless stations at Mombasa, in British East Africa, and in German East Africa, as well as in Ceylon.

The United Fruit Co. proposes establishing a wireless station at Bocas del Toro, in Panama.

Communication with Canada.—Mr. A. M. Grenfell, who recently returned from an extended tour in Canada, states that cheaper communication is urgently required, especially with Western Canada, where the news is mainly derived from American sources, and is coloured accordingly. In his opinion the lowering of the rates for cable messages is the most pressing Imperial question at present.

Austria.—Answering a deputation of the Reichenberg Chamber of Commerce, the Austrian Minister of Trade and the head of the Postal Department stated that an extension of telephone facilities in the Dual Monarchy can only take place after a loan has been sanctioned. Austria spends yearly 5,000,000 kronen on the upkeep of her telephones, but the works outlined by the deputation involved an expenditure of 70,000,000 kronen. They embraced three classes of expenditure: Modernisation of old exchanges, erection of new ones, and establishment of various inter-urban telephone communications.—*Der Elektrotechniker.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—November 26th. Incandescent lamp fittings for street lighting; also meters, current limiters, time switches and fuses, for 12 months, for the U.D.C. See "Official Notices" to-day.

Australia. — November 19th and 22nd. Telephone cable and testing instruments, for the P.M.G.'s Department. See "Official Notices" October 7th.

January 4th, 1911.—Three multiple switchboards, for the P.M.G.'s Department in New South Wales. See "Official Notices" November 4th.

November 23rd.—Cable, ironwork, pipes, conduits, switchboards, telegraph and telephone instruments, &c., for the P.M.G.'s Department in Queensland. See "Official Notices" September 30th.

December 29th.—(*a*) Telephone cable, (*b*) battery and line material and instruments, for the P.M.G.'s Department in South Australia. See two "Official Notices" November 4th.

January 4th, 1911.—Iron poles, ironwork, and switchboards, for the P.M.G.'s Department in Queensland. See "Official Notices" to-day.

January 10th, 1911.—Telephone cable, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

January 10th, 1911.—Contacts and condensers, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

February 6th, 1911.—Arc lamp carbons, for the Sydney Corporation Electricity Department. Specifications, City Electrical Engineer, Queen Victoria Markets, Sydney.—*Australian Mining Standard.*

Belgium.—December 7th. The Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the supply and installation of the overhead electric equipment for the new electric railways in the Louvain district.

December 21st.—Electrical overhead equipment of the Laeken-Wemmel railway for the Société Nationale des Chemins de Fer Vicinaux, Brussels.

Bispham-w.-Norbreck.—November 21st. Gas producer and electrical plant for the proposed generating station, for the U.D.C. See "Official Notices" November 4th.

Canada.—Winnipeg.—December 1st. Board of Control. Poles and line supplies for the city electrical distribution system. Specifications, &c., from Smith, Kerry & Chace, Carnegie Library Building, Winnipeg. Deposit required.

Gateshead.—November 24th. Arc lamp carbons (Form 25), electric lamps (26), electric wires and cables (27), electric light sundry fittings (27*a*), and glasses for electric arc lamps (33*a*), for a year from January 1st, for the North-Eastern Railway Co.; E. H. Clark, Stores Superintendent, Gateshead.

India. — December 1st. Overhead electric and hand travelling cranes, with rails, conductors, motors, &c., for the Cossipore station and sub-stations of the Calcutta Electric Supply Corporation, Ltd. See "Official Notices" November 11th.

Invercargill (New Zealand). — January 9th, 1911. Power-house plant, cars, rails, overhead material, wires and cables, poles, &c., for an electric trolley system, also street-lighting plant, for the Corporation. See "Official Notices" October 14th.

London.—L.C.C.—December 6th. Ash-dust removing plant, for the East Greenwich generating station. See "Official Notices" October 28th.

December 6th.—Overhead electrical equipment for tramways between Putney Bridge and Wandsworth High Street. See "Official Notices" November 11th.

Bethnal Green.—One thousand 100-volt, 22-c.p. metallic-filament lamps, for the Board of Guardians. See "Official Notices" October 28th.

November 19th.—The Port of London Authority is inviting tenders for supplies for 12 months, including electric light carbons, incandescent electric lamps, glass and glassware, asbestos goods, &c. Manager, Stores Department, 106, Fenchurch Street, E.C.

Newcastle-on-Tyne. — November 23rd. Incandescent lamps and arc lamp carbons (Section 23), for the Tyne Improvement Commissioners; J. McDonald Manson, Secretary, Berwick Street, Newcastle.

Newport.—November 25th. Armature and field coils for Dick, Kerr 25 A and 35 A motors, and Westinghouse 46 motors, for the Corporation. See "Official Notices" to-day.

New Zealand.—December 5th. For New Zealand Post and Telegraph Department. (1) 50 tons of galvanised-iron wire; (2) 100,000 Leclanché zincs; (3) 25 tons of hard-drawn copper line wire. Controller Department, Wellington. Deposits for (1) and (2) respectively, £20, and for (3), £50. Specification can be seen at the Board of Trade C.I. Department, London.

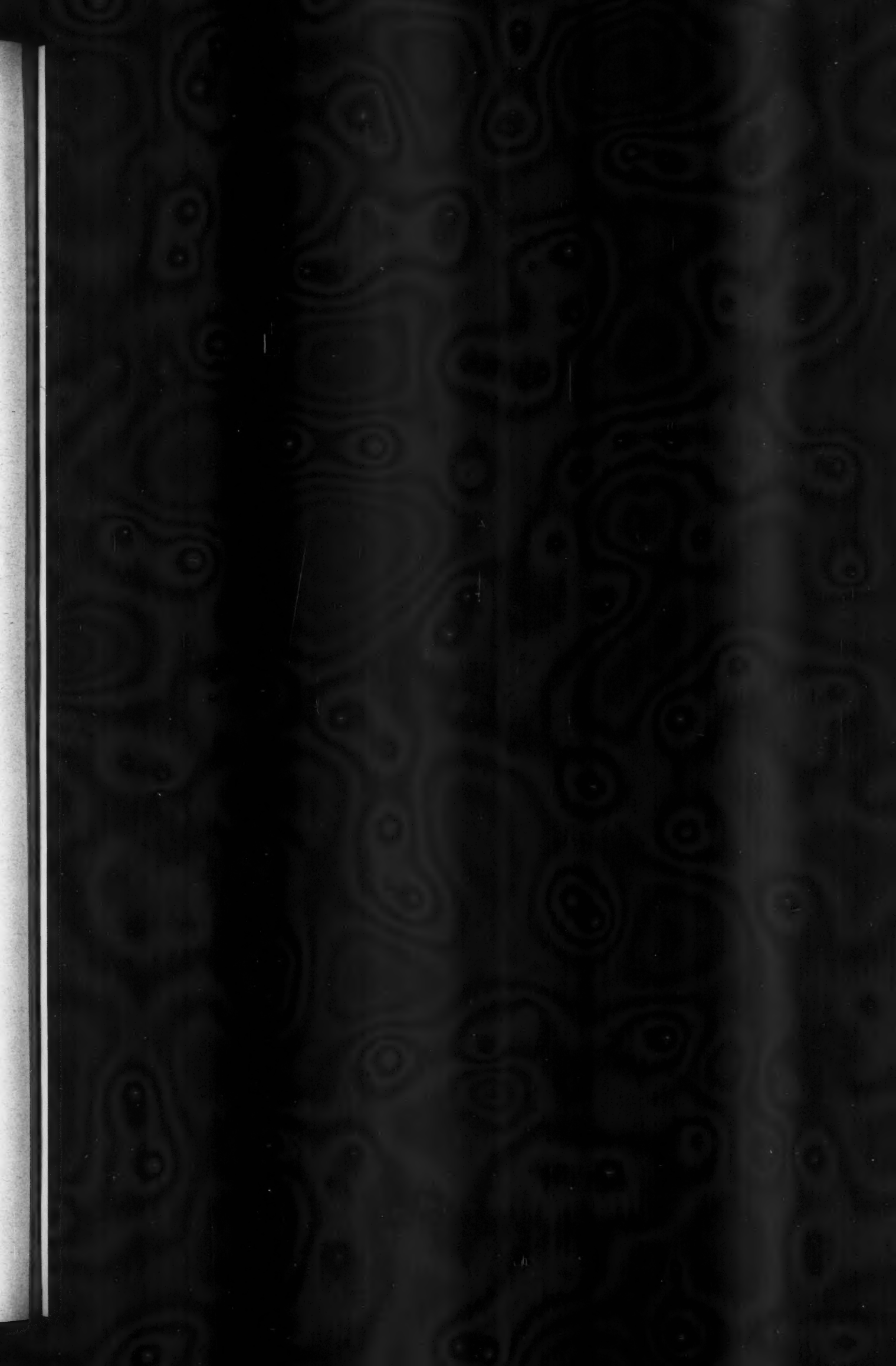
Northwich (Cheshire).—November 28th. Tenders are invited by the U.D.C., in connection with the proposed sewage scheme (the engineer to which is Mr. W. M. Beckett, of 33, Brazennose Street, Manchester), for the supply and erection of electrically driven sewage-pumps and motors.

Roumania.—December 18th. The municipal authorities of Botoshani are inviting tenders for the establishment of a central electric lighting station in the town.

Southampton.—2,000 radiator lamps, for the Corporation Electricity Department. See "Official Notices" November 4th.

Spain.—January 11th. The Spanish Ministry of Public Works in Madrid are inviting tenders for the concession for the construction and working of an electric tramway between Catanoja and Silla (province of Valencia).

(*Continued on page* 831.)

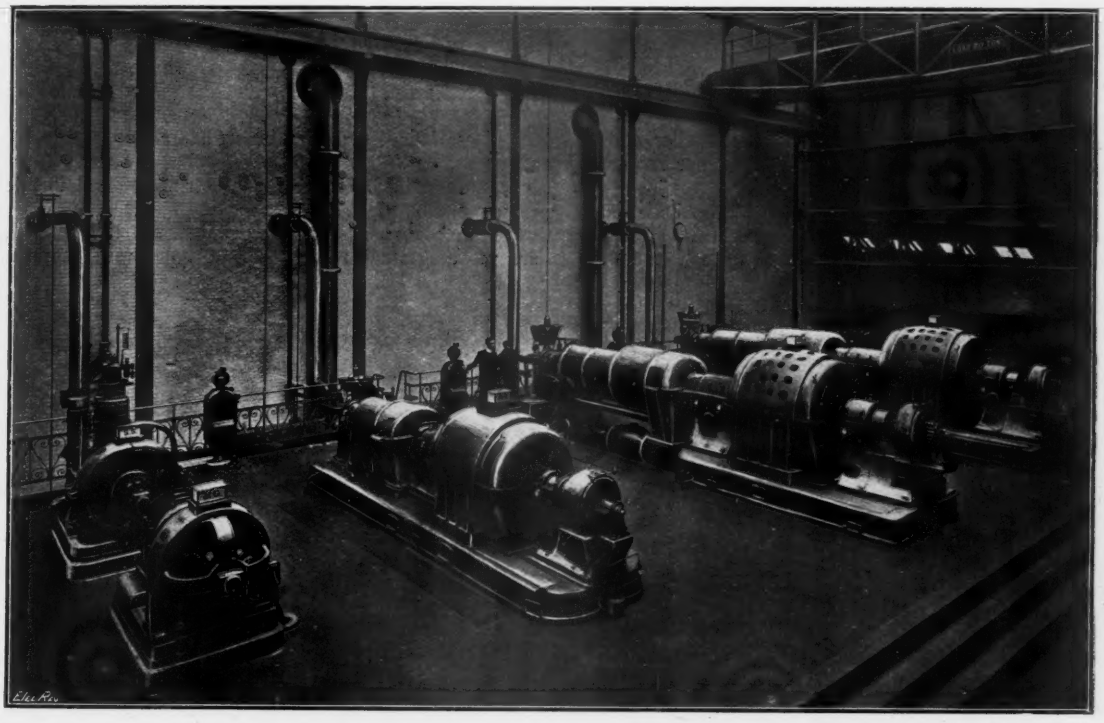


THE GENERAL POST OFFICE POWER SUPPLY.

For some time it has been generally known that an up-to-date scheme for providing for the supply of electricity for lighting and power purposes, to the great Post Office buildings in St. Martin's-le-Grand and Carter Lane, was being undertaken by the Post Office authorities.

The greater portion of this scheme has now been completed, and a Press view of the new power station near Blackfriars Bridge, and the sub-stations at St. Martin's-le-Grand, was held on Friday last, at the invitation of the Postmaster-General.

The new arrangements are designed to supersede the isolated generating plants, which have been in use for many years, also the steam-driven pneumatic pumps in the G.P.O. West, and to cope with the growing demand for power for various purposes, such as charging telephone batteries, the operation of lifts, conveyors, ventilators, &c., in a most efficient manner.



Turbo-Generators, &c., Installed at the P.O. Power Station, Blackfriars.

A very complete description of the scheme is contained in a paper read before the Institution of Post Office Electrical Engineers, on Monday last, by Mr. H. C. Gunton, who has latterly controlled this department.

The generating station, a steel and brick structure, supported on a concrete raft, is situated near the southern end of Blackfriars Bridge, and is designed to supply three-phase current at 6,600 volts and 50 periods; it contains some 2,500-kw. of generating plant, and provision for extension has been made.

Owing to its location on the river, the supply of both fuel and water for condensing is simplified. The boiler house, which adjoins the river, is equipped with seven Stirling boilers of the four and five-drum types, having evaporative capacities of 17,750 and 20,000 lb. steam per hour, at 200 lb. pressure and superheated to some 550° F.

Each boiler is equipped with a Ferguson superheater and chain-grate stoker, and the plant is worked in conjunction with a Clay Cross economiser of 640 tubes, the flue gases being discharged through a brick chimney 180 ft. high and 8 ft. diameter.

Fuel will normally come to the station in barges, from which it is transferred by an electrically-operated crane with a 15-cwt. grab, situated on the roof of the boiler house, to an Ingrey automatic weighing machine, which feeds it on to a bucket conveyor for distribution to the bunkers.

The latter are of steel, divided into seven sections each of about 100 tons capacity, and occupy a position over the firing floor; the fuel gravitates from them into either of two travelling Ingrey weighers, from which any desired stoker hopper can be replenished.

The conveyor is of the endless pattern, and passes from the bunkers down into the basement below the firing floor for the collection of ashes, which are discharged into an ash hopper at the west end of the building.

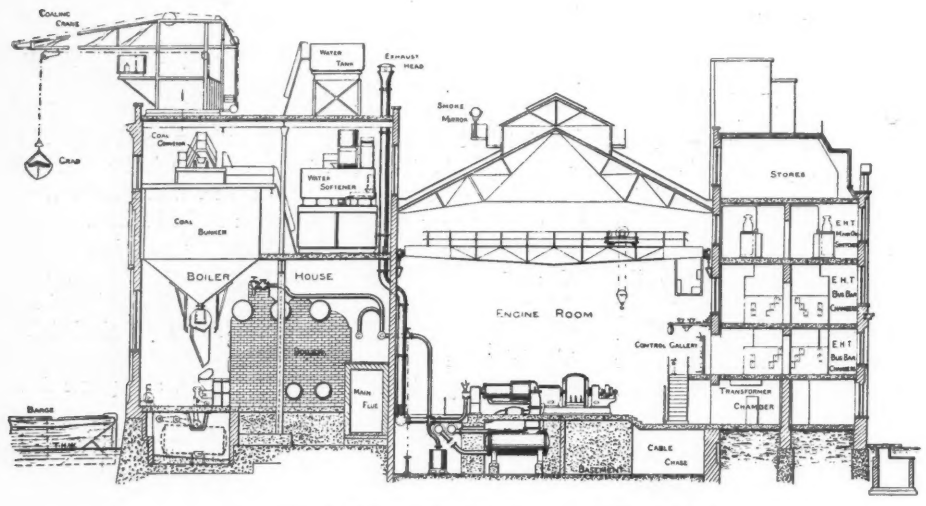
The feed pump equipment consists of Worthington motor-driven centrifugal and Hall duplex-steam pumps, and an injector is also provided; each unit is of 3,000 gallons per hour capacity. Both the suction and delivery pipes are in duplicate, and the hot-well supply to the former is supplemented by water from the public mains, which is preliminarily treated in a Paterson water softener. Three Lea recorders are provided at the hot well, one of which registers make-up feed, while the other two are available for measuring the condenser discharge to the hot well.

The steam pipe arrangement includes a sectionalised 8-in. header, with the ends coupled, ring form, by a 6-in. main; also a 3-in. saturated steam main for the steam-driven auxiliaries.

Drainage is provided for by steam pockets and natural drainage to the turbine separators, which are fitted with Alley

and Maclellan steam traps, and from which the water is returned to the hot well.

The generating plant installed in the engine room comprises two 1,000-KW. Willans-Dick Kerr turbo-alternators, and a smaller 500-KW. turbine set by the same makers. The



Sectional Elevation, Post Office Power Station.

larger sets run at 1,500 R.P.M., and the smaller one at 3,000 R.P.M.; overload capacity of 50 per cent. for two hours is provided for.

The turbines are of the compound impulse-reaction type and exhaust direct into surface condensers in the basement, an atmospheric by-pass being provided in each case; the condensers are fitted with vacuum augmentors and three-throw Edwards air-pumps, motor-driven through gearing.

The circulating system is, like others on Thames-side, necessarily complicated by the addition of mechanical strainers to keep out the straw, leaves, and other rubbish carried in the river water.

Three 24-in. pipes extend some 200 ft. into the river to a concrete apron with pits and gratings; normally one pipe is used for discharge and one of the others for suction purposes, according to which is on the cool water side of the discharge.

The shore ends of the pipes terminate in catch pits with straining grids; these are situated in a strainer pit which contains also the two mechanical strainers—one of which is a Bailey & Jackson rotary type machine driven by a 2-H.P. motor and the other a reciprocating strainer of the Willans-Roberts type. The former strainer has been frequently described; owing to the leakage past the grids, it is preferably placed between the circulating pumps and the condenser.

The Willans-Roberts strainer is a new thing; it consists of three plungers fitted with grids and operated by a three-throw crankshaft gear-driven by a 5-H.P. motor.

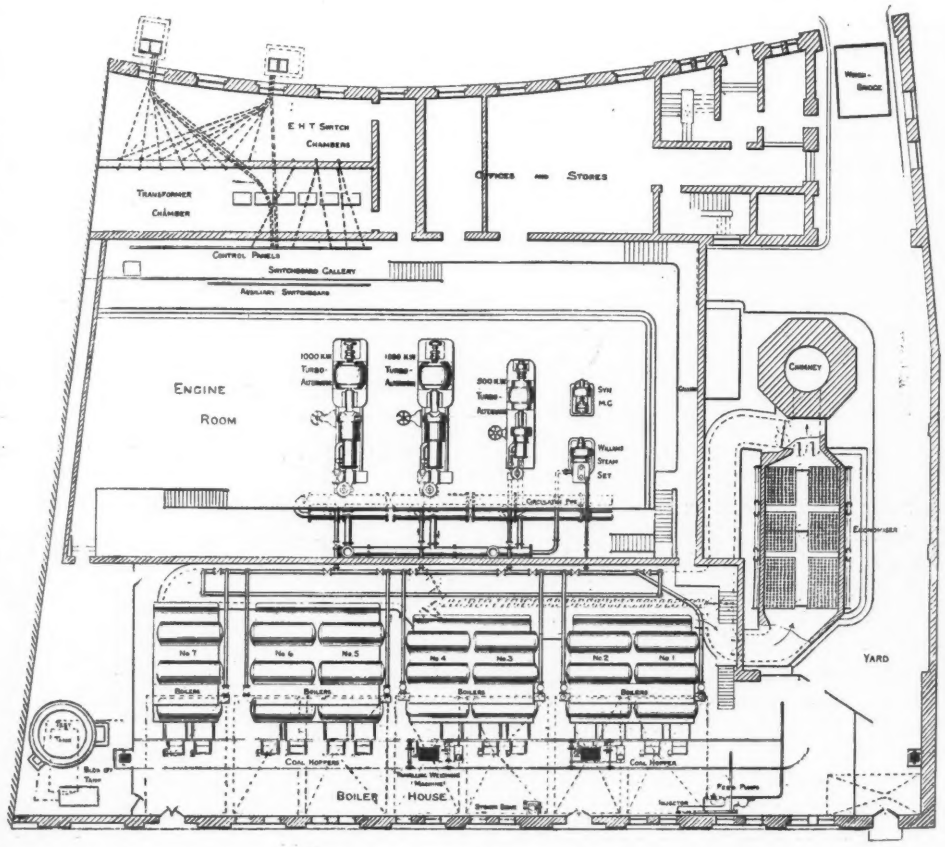
The grids are alternately inserted in the suction and delivery pipes, the 3-crank arrangement enabling the full-bore capacity to be maintained. There is practically no leakage with this machine, and it can be placed on the river side of the circulating pump, protecting the latter.

The circulating pumps are of the vertical-spindle centrifugal type, three in number; two are driven by 50-H.P. motors, and have a capacity of 3,000 gallons per min. each, while the other is coupled to a 25-H.P. motor.

The circulating system being a closed one, a siphonic action obtains, and the pumps have only pipe friction to overcome when started.

For priming purposes and for ridding the pipes of air, two steam ejectors and an electrically-driven air-pump, which can be connected to one leg of a barometric pipe, are provided. A Venturi meter is inserted in one of the circulating pipes.

Turning to the electrical equipment, the alternators are of the usual revolving field type, with star-wound



Plan, Post Office Power Station.

stators, the neutral points of which can be separately earthed through a single-pole switch and resistance, although it is proposed normally to work with an unearthed neutral.

Each alternator is provided with its own exciter mounted

on the end of the main shaft, and alternative means for exciting are provided by auxiliary plant working in conjunction with L.T. three-phase 110-volt bus-bars.

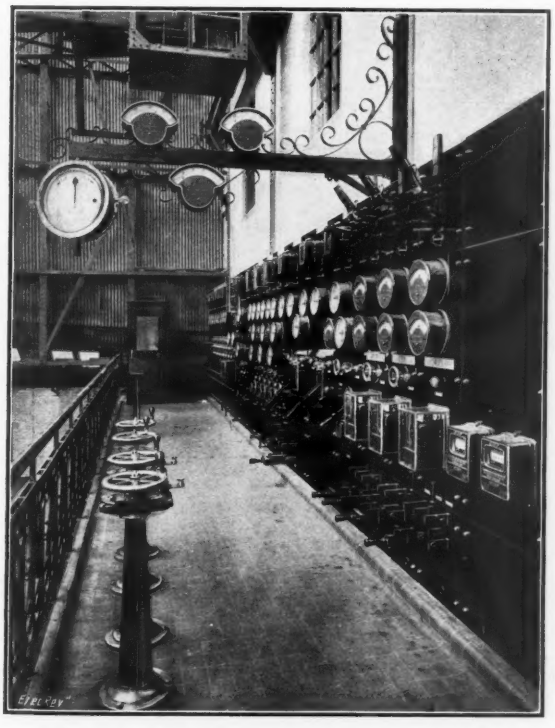
The auxiliary plant includes a 35-KW. steam dynamo, a 60-cell battery, and a 35-KW. motor-generator with transformers coupling it to the H.T. bus-bars, and it provides also for the supply to the station power and lighting circuits. Practically all the motors in the station, 28 in number, are of the three-phase slip-ring type, and are operated by Bray, Markham and Reiss switch panels; a few small motors are of the squirrel-cage type.

The engine room is spanned by a 3-motor 20-ton traveller, by Broadbent and Co.

The E.H.T. switchgear for controlling the output of the station is of the Westinghouse type, with solenoid operated triple-pole oil switches, and is isolated in stone cells in the usual way. The E.H.T. control switchboard occupies a position on a gallery overlooking the engine-room, with the L.T. switchboard for the station circuits immediately below it.

The main E.H.T. bars are in duplicate on separate floors, with the oil switches on the top floor. The whole of the E.H.T. gear is further subdivided by a longitudinal wall, each set of bus-bars being in halves coupled by a switch. The generator and feeder circuits can, by means of selector switches, be coupled to either set of bars; the generator panels are fitted with reverse current and the feeder panels with overload relays, and the bus-bar pressure is automatically controlled by a Tirrill regulator.

The E.H.T. transmission system to the sub-stations consists



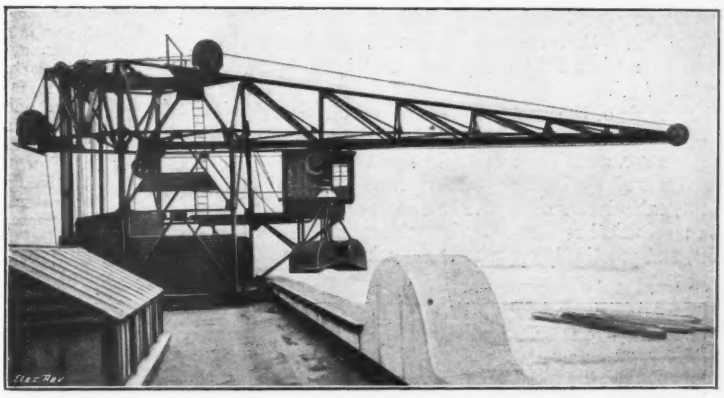
E.H.T. Control Switchboard, Power Station.

of six main feeders, each consisting of three (·05 sq. in.) core paper-insulated lead-sheathed cable, mostly provided with a copper earth shield and drawn into P.O. ducts. Armoured cable is used on Blackfriars Bridge, where it is drawn into iron pipes, and in a few other places.

Two feeders run to each of the sub-stations, viz., in King Edward Building, G.P.O. West and G.P.O. South, and in addition two inter-connectors link up the first two sub-stations, and one inter-connector the last two.

No charging apparatus is provided for the E.H.T. cables, which are switched straight on to the bus-bars.

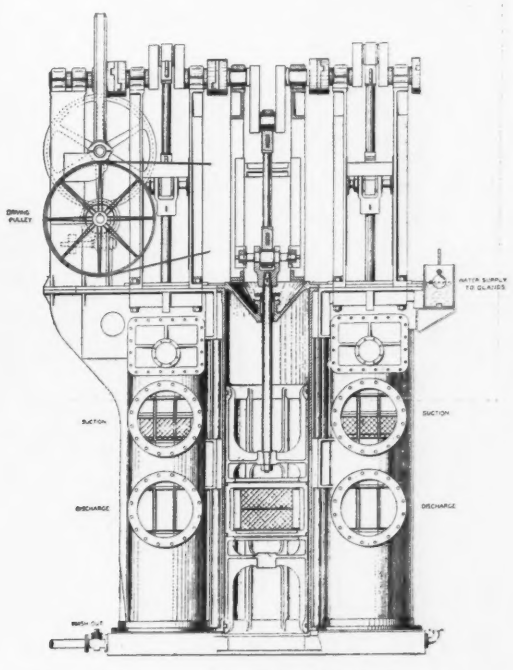
For various reasons a dual supply—both alternating and direct current—was considered preferable in connection with the sub-stations, two of which, at King Edward Building and the G.P.O. South respectively, are of the static type, supplying alternating current for lighting and power purposes



Babcock Coaling Crane, on the Boiler House Roof.

in those buildings, while the third at G.P.O. West is equipped with motor-converters working in conjunction with a large floating storage battery, and normally supplies direct-current for all lighting and power purposes in G.P.O.'s West and North, and also to G.P.O. South and King Edward Building for battery charging, &c.

Moreover, by means of suitable reverse relays at the sub-station ends of the E.H.T. feeders and in the direct-current bus-bars, the battery will, in the event of a temporary failure of the E.H.T. supply, not only maintain the direct-current



Willans-Roberts Reciprocating Strainer, for Circulating Water.

supply, but also by reversal of the motor-converters, automatically maintain the E.H.T. supply to the other two sub-stations.

The principal sub-station is that at G.P.O. West, which contains a bank of four 300-KW. Bruce Peebles motor-converters, with the E.H.T. switchgear on one side and the L.T. direct-current board on the other. The motor-boosters used in connection with the battery occupy one end of the building, the battery being in a separate room.

The battery is divided into halves, each consisting of 55 E.P.S. cells, and coupled through a B.T.-H. 40-KW. reversible booster, between the neutral and one of the outers of the three-wire distribution system; either half can be charged or discharged without affecting the pressure of the distribution system. The battery is specified to give discharges of 1,100 amperes for three hours, 2,000 amperes for one hour, and 3,000 amperes for 15 minutes. Each cell stands on insulators let into two independent bearers, supported on other insulators on wood strips; it is claimed that this arrangement renders leakage less likely than when long bearers are employed to support a number of cells.

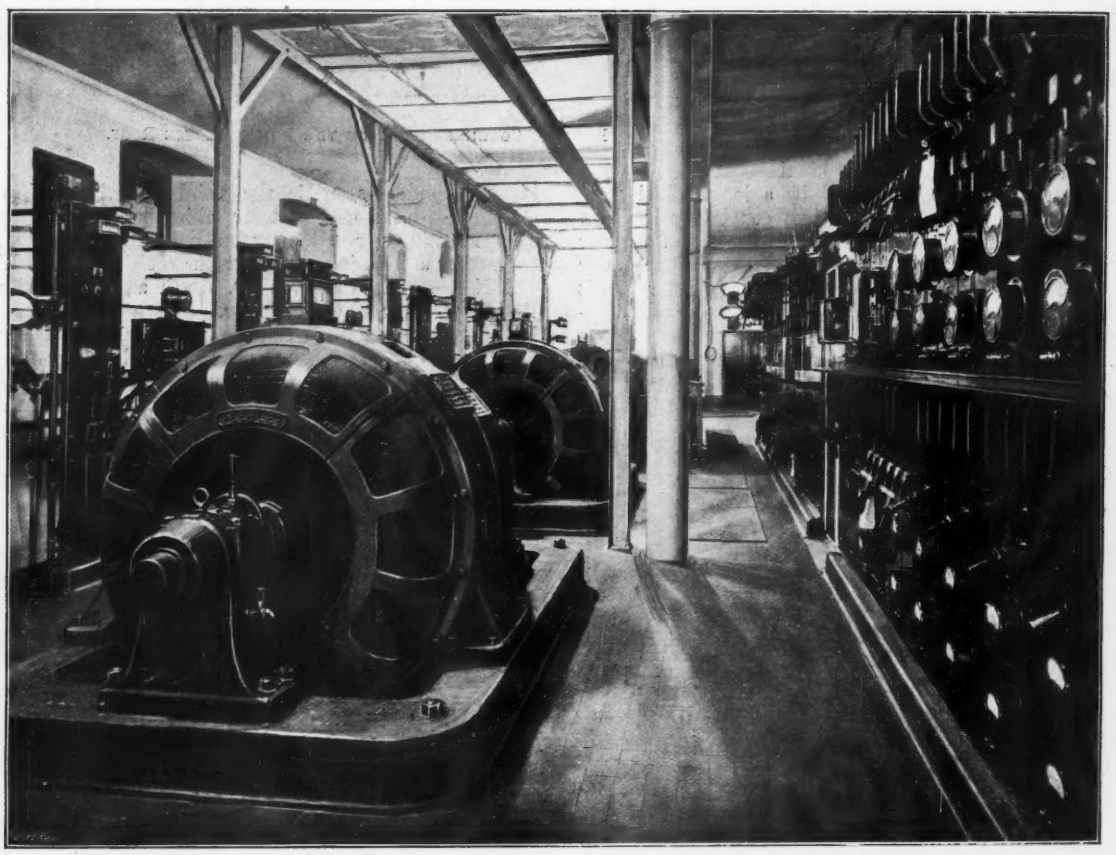
The whole of the switchgear in this and the other sub-stations was supplied by the B.T.-H. Co.

The E.H.T. switchgear is enclosed in stone cells, which, on account of the limited distance from back to front and height, extend down practically all one side of the building, with mechanical remote-control panels placed at intervals in front, and practically opposite the machines which they control. The spaces between the control panels accommodate the starting switches for the converters. The E.H.T. bus-bars are in duplicate, a set running along the top and bottom of the cell work respectively, with selector switches for coupling to the oil switches, isolating switches, instrument transformers, &c., which occupy cells in the space between the two sets of bars.

There are no shields between phases, but ample clearances are allowed; static dischargers (the only ones in the system) are provided in the motor circuits, which are also provided with water-charging resistances connected to auxiliary contacts on the main oil switches.

The control board includes four motor, two feeder, three interconnector and one bus-bar coupling panel; overload relays are fitted on the motor panels, and both overload and reverse current relays on the feeders, but, of course, not on the interconnectors, which are intended to permanently couple the several sub-stations in case of mishap to the supply.

(To be continued.)



View in the Sub-station, G.P.O. West, showing Motor-Converters and Switchgear.

A Magnetic Fault Finder.—A magnetic fault finder for locating "shorts" and "earths" in three-phase and other cables has been brought out in the United States, which appears to be of considerable interest, and, according to the New York *Electrical World*, has replaced the ordinary loop test in several large cities. As usual, signal current, supplied by a mechanical interrupter, is sent out, passing through the fault and returning over the sheath or adjacent conductor. This interrupter is operated from a 110-volt motor, and is placed at the cable terminal, while the explorer and receiver set is carried along the cable. The sound produced by the signal current is unmistakable, being sharp and intermittent. The interrupter is designed to give a maximum sound with a small testing current, the latter being only a fraction of an ampere.

The exploring coil used with this device localises the fault exactly. It is a longitudinal explorer, and operates in quite a different manner from the ordinary form, in which the winding is parallel to the cable conductor. The windings of the longitudinal coil are perpendicular to the cable, and the coil operates from the high and low magnetic areas lengthwise along the cable, produced by the twisting of the conductors.

When a signal current goes out over one phase and back over an adjacent phase, or over the sheath, there are formed two longitudinal spiral strips of condensed lines of magnetic force on opposite sides of the cable, one strip being positive and one negative. When the explorer is placed lengthwise along the cable, it bridges over from a high to a low magnetic potential, and hence there is a heavy flux through the winding of the explorer, which causes a loud signal in the receivers.

Returning on the sheath, the current produces the same effect as if the current returned on a wire in the centre of the cable. As the conductors are spirally disposed about the centre of the cable, as well as about each other, an "earth" produces longitudinal high and low areas, as well as a "short." If the current goes out and practically all returns over the earth, the strips of lines will not be produced, as the flux will not be crowded into close quarters, and the spiral tufts will not be formed. In this case only a practised ear can detect a difference of magnetic potential longitudinally. By turning the explorer across the cable, however, the testing current can be loudly heard, but the operator will also hear the current in the sheath.

In the normal position the explorer is entirely neutral to sheath current, whether in the cable under test or in adjacent parallel cables. The explorer can be adjusted, if necessary, until no sheath current is heard, by moving its position until its ends are at the magnetic potential produced by the sheath current. There is then heard in the explorer only the spiral conductor current, and this permits detection of the exact point at which the current passes from the conductor to the sheath, the point being indicated by a sudden absence of sound, and this point being the fault.

CONTRACTS OPEN.

(*Continued from page* 826.)

Turkey.—December 28th. The date for the receipt of tenders for electric tramways in Constantinople and suburbs has been extended from November 10th to December 28th.

Walthamstow. — November 25th. One 1,000-KW. mixed-pressure turbine, with tandem generators of 500 KW. each, and surface condenser and pipework, for the U.D.C. See "Official Notices" November 4th.

Watford.—The U.D.C. has asked for tenders for a year's supply of electric meters.

West Ham.—November 28th. Installing electric light at Salway Place Schools, Stratford, E., for the Education Committee. See "Official Notices" to-day.

Wigan.—November 28th. Low-tension lead and paper-covered cables, and low-tension lead, paper and armoured cables, for the Corporation. See "Official Notices" to-day.

York.—November 24th. Telegraph apparatus and telegraph wire and line stores, for a year from January 1st, for the North-Eastern Railway Co.; C. H. Ellison, Telegraph Superintendent, York.

CLOSED.

Australia.—The P.M.G.'s Department, Queensland, has ordered 4,487 four-duct glazed earthenware conduits, at 3s. 6d. each, from the Virginia Brick Co. The P.M.G.'s Department, South Australia, has ordered 120 switchboards, common battery, at £6 18s. 2d. each, 70 at £9 2s. 6d., 30 at £14 13s. 6d. each, also 100 telephones at £2 11s. 3d., and many other telephone supplies, from the Western Electric Co., Australia, Ltd. From the B.I. and Helsby Cables, Ltd., 1,200 wall sets at 38s. 6d. each, also various switches, cords and switchboards, have been ordered by the same department. The Public Works Department, New South Wales (Railway and Tramway Construction Branch), has contracted with Mr. Thomas Johnson, North Sydney, for the construction of permanent way, including "Thermit" welding and track bonding, for an electric tramway from Military Road, North Sydney, to Cremorne Point, at schedule rates.—*Australian Mining Standard.*

Berks.—The C.C. has accepted the tender of Messrs. Strode, of London, for electric light fittings for the new County buildings at Reading, at £325; and that of Messrs. G. Hawkes and Sons, of Reading, for inter-departmental telephones, at £210.

Crompton (near Oldham).—The electricity contract in connection with the sewage works has been let to Messrs. Edmondson, of Westminster.

Farnworth.—The contract for the electric lighting of the new Carnegie Library has been placed with Messrs. A. S. Dewhurst & Co., of Manchester.

France.—Mr. Chas. Taylor, of Birmingham, has received from Paris an order for 49 of his patent spiral self-centring chucks, for one of the French arsenals.

G.W. Railway.—The tender of Messrs. Jones Bros. (West Bromwich), Ltd., has been accepted by this railway company for refined Trinidad bitumen during the next 12 months.

India.—*Indian Engineering* states that Messrs. Pritchetts and Gold, Ltd., recently received an order for the supply of 600 accumulator cells to the East Indian Railway Electrical Department.

Italy.—The municipal authorities of Rome have placed the contract for the necessary material for several sub-stations in connection with the electric tramway system, as well as for 35 sets of 40-H.P. double-motor tramcar chassis, with the Société des Constructions Electriques, of Charleroi, Belgium.

London.—L.C.C.—The Highways Committee recommends that the tender of the British Westinghouse Electric Co., Ltd., for the supply and erection of standard-type controllers, electrical interlocking gear, and additional cables for 100 double-deck cars, at £6,490, be accepted.

For cooling fans and filter frames, &c., for the first two turbo-generators just supplied to the Greenwich generating station, the Committee received tenders as follows:—

Matthews & Yates, Ltd.	(recommended)	£374
Standard Engineering Co., Ltd.		378
Westminster Ventilating Co.		425
Jas. Keith & Blackman Co., Ltd.		449
Sturtevant Engineering Co., Ltd.		492
Davidson & Co., Ltd.		495

The connecting-up of motors for this plant will be done by the department, at a cost of £60.

Long Eaton.—The U.D.C. has ordered for its electricity works two "Bennis" high-duty smokeless and gritless coking stokers and self-cleaning compressed-air furnaces from Messrs. E. Bennis & Co., Ltd. This is a repeat order.

Spain. — La Sociedad Hydro-Electrica Espanola has placed a contract for an 8,000-H.P. steam turbine and generator with the Siemens-Schuckert Industria Electrica Co. The new plant is intended to be installed as a reserve generating set at the electricity generating station of the company in Madrid.

Sunderland.—The Corporation Electricity Department has accepted the tender of Messrs. W. G. Farrow & Co. for the supply of cast-iron piping for stock.

FORTHCOMING EVENTS.

Faraday House O.S.A.—Friday, November 18th. At 8 p.m. Annual smoking concert. At Holborn Restaurant (Council Room). See "Notes" to-day.

Institution of Electrical Engineers (Glasgow Students' Section).—Friday, November 18th. Meeting at 8 p.m. At the Technical College, Glasgow.

Institution of Mechanical Engineers.—Friday, November 18th. At 8 p.m. At the Institution House, Storey's Gate, S.W. Paper on "The Development of Road Locomotion in Recent Years," by Mr. L. A. Legros.

Electro-Harmonic Society.—Monday, November 21st. At 8 p.m. At the Holborn Restaurant. Concert. Ladies' night.

Leeds University Engineering Society.—Monday, November 21st. Paper on "Recent Developments in Foundry Theory and Practice," by Mr. R. Buchanan.

Royal Society of Arts.—Monday, November 21st. At 8 p.m. Cantor lecture on "Industrial Pyrometry," by Mr. C. R. Darling. (Lecture I.)

Wednesday, November 23rd. At 8 p.m. Paper on "Methods of Detecting Fire-Damp in Mines," by Sir H. H. Cunynghame.

Junior Institution of Engineers.—Monday, November 21st. At 7.30 p.m. At Caxton Hall, Westminster, S.W. Lecture on "The Law Relating to Engineering," by Mr. L. W. J. Costello. (Lecture IV.)

Saturday, November 26th. At 2.30 p.m. Visit to Messrs. D. Kirkaldy and Son's Testing and Experimental Works, Southwark Street, S.E.

Institution of Electrical Engineers (Newcastle Section).—Monday, November 21st. At 8 p.m. At the Armstrong College Newcastle. Discussion on "Electric Winders," to be opened by Mr. J. G. Wilson.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, November 22nd. At 7.30 p.m. At the University, Manchester. Paper on "Street Lighting by Modern Electric Lamps," by Mr. H. T. Harrison.

Institution of Electrical Engineers (London).—Thursday, November 24th. At 8 p.m. At the Institution Building, Victoria Embankment, W.C. Paper on "Street Lighting by Modern Electric Lamps," by Mr. H. T. Harrison.

Physical Society.—Friday, November 25th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "The Electric Stress at which Ionisation begins in Air," by Dr. A. Russell; and "Exhibition of a Brightness Photometer," by Mr. J. S. Dow.

Association of Engineers-in-Charge.—Saturday, November 26th. Social. Dance.

NOTES.

Physical Society's Exhibition.—The annual exhibition of the Society will be held on Tuesday, December 20th.

L.G.O.C. Electrical Department—Second Annual Dinner.—On Saturday last the second annual dinner and concert of the London General Omnibus Co.'s electrical department was held at the Hotel Europe, Leicester Square. Mr. Stuart A. Curzon presided, with Mr. W. Fotheringham as vice-chairman, and there were about 100 guests present. Mr. Harold Plumridge proposed the toast of the "L.G.O.C. Electrical Department," and remarked that he thought they would all agree that it was second to none in the country. The chairman, in reply, said that, in the past year, the department had carried out a large amount of work at prices absolutely unheard of by contractors, and some of the representatives of the wholesale firms present would, if they were got into a corner, have to admit that the department was buying goods at prices which they were ashamed to sell them at. Mr. Fotheringham gave the health of "The Ladies and the Visitors," which was responded to by Mr. B. C. Evans (Veritys, Ltd.). An excellent concert was provided, under the direction of Mr. Gerald Dennison, by the following artistes: Miss Amy Page, Miss Happy Carton, Mr. T. Nivin Jones, Mr. Will Bentley, Mr. Fred Curtis, Mr. Arthur Melrose and Mr. Ambrose Vink.

Gas Turbine.—It is reported that Messrs. Brown, Boveri and Co. will shortly place a gas turbine on the market. They have already constructed, and had running for some time, a 300-H.P. turbine, and are now experimenting with a 1,000-H.P. machine. The new invention is the work of Messrs. Holzwarth & Junghaus.

The Royal Mint.—The fortieth Annual Report of the Deputy-Master and Comptroller of the Mint shows that during the year 1909 113,139,480 coins to the value of £15,687,667 were produced. The corresponding figures for the previous year were 126,483,042 and £15,620,240 respectively.

The supply of British silver coin to the Commonwealth of Australia terminated with the year under review, and, under an arrangement with His Majesty's Government, a local silver currency is gradually taking its place.

The memorandum by Mr. Rigg, Superintendent of the Operative Department, shows that in the silver and bronze melting house the

weight of metal produced is the largest on record, and, for the first time for many years, the whole of the metal coined was melted on the Mint premises. In view of the fact that the melting houses are now in course of reconstruction on an enlarged scale, and that it is proposed to use gas or oil, or both, as fuel in the new buildings, in place of the coke hitherto used, experiments have been conducted to determine the best arrangements to adopt in the future.

Some figures given in connection with the electric plant show that since 1900 the extension of the use of electricity has been very rapid.

During that period the number of motors in use has increased from 20 to 73, and the gross horse-power from 47 to 673. In addition some 78 arc lamps and about 1,000 incandescent lamps are in use.

The average number of units generated per month by the Mint generators during 1909 amounted to 22,841.

The report of Dr. T. K. Rose contains particulars of a re-arrangement which has been carried out in the Assay Department, of the driving gear of the bottle shaking plant. Two copper shaking boxes are used to effect the aggregation of the silver chloride in the Gay Lussac process for the assay of silver bullion. Each is capable of holding 20 bottles, which are shaken with a vertical jigging motion, the total throw being 2½ in., and the speed 300 R.P.M. nstead of 240 R.P.M. as formerly.

The aggregation of the chloride ensuring perfect settlement is completed in about two minutes, or somewhat less than was the case when the speed was 240 R.P.M. The whole plant now rests on an iron bedplate fixed to a concrete base, and is driven by a 1-H.P. Siemens motor by means of Renold chain gear. Either machine can be driven independently, and friction clutches ensure their coming promptly to rest when required.

The heating of the assay furnaces has been improved by enlarging the combustion chambers round the muffles and filling the entire space with clay fire-balls resembling those used in ordinary gas stoves. These act as baffles and ensure complete combustion. As a result, more rapid heating of the furnace is possible, and the temperature is more uniform and under better control. The principle is capable of application to larger furnaces.

In the report of the Deputy Master of the branch Mint at Perth a description of a new file for reducing heavy blanks is given. It is electrically driven, and the blanks are fed through a vertical hopper, no further attention being required. After being uniformly filed round the circumference they fall into a receptacle, and are then removed for automatic re-weighing.

Italian Hydro-Electric Developments.—The Italian Association for Electrical Enterprises recently issued a volume giving a large amount of statistical information concerning the principal electrical undertakings in Italy, and the work has been used to form the "raw material," it is said, of a series of articles from a Milan correspondent of a Frankfort newspaper on the subject of the hydro-electric works in Italy. It is stated, in the first place, that Italy has reached the turning point in the history of her water-power installations. During the past five years an average of almost 100,000 H.P. in water power has been installed, and large works are still in course of construction. Scarcely 100,000 H.P. were installed at the beginning of 1904, but on the completion of the works in hand, the power will be increased to about 750,000 H.P. This rapid development has taken place principally in the north of the country, and in the opinion of authorities an over-production of electric power is threatened there. On the other hand, attention has recently been devoted to the opening-up of the large water powers in the south and in Sicily, where a large field is open for the use of electric power. German capital and industry, as well as those of Switzerland, have participated considerably in the development of the water powers in Italy. The Germans are represented in these respects by the Schuckert Co., the Lahmeyer Co., and the A.E.G.; and the Swiss by the Zurich Bank for Electrical Enterprises, the Swiss Electrical Industry Co., of Basle, and Brown, Boveri & Co. In addition to being financially interested in Italian hydro-electric works, the Germans and Swiss are suppliers of considerable quantities of machinery, turbines, dynamos and motors, accessory appliances, measuring instruments, and cables. The A.E.G. and the Siemens-Schuckert Works have a turnover in Italy of from £400,000 to £600,000 per annum, and the total imports from Germany and Switzerland are of the annual value of about £2,000,000. The A.E.G. and Brown, Boveri and Co. have subsidiary works in Italy, and the reason for establishing them was not only to escape the import duties, but also to have regard to the national feeling, especially of public authorities, that preference should be given to native manufactures. It is estimated that water power to the amount of 50,000 H.P. is available in Sicily. The Eastern Sicilian Electric Supply Co. is engaged in installing plant of 19,000 H.P. on the rivers Cassibile and Alcantara, and is constructing a transmission line 124 miles in length along the eastern coast of the island, with branches into the interior. It is considered that it will be of advantage to substitute electric motors for the 20,000 H.P. of steam plant used in connection with the sulphur mines in Sicily.

Electro-Harmonic Society.—Next Monday evening, at 8 o'clock, at the Holborn Restaurant (King's Hall), will be "Ladies' Night" at the Electro-Harmonic. The artistes are as follows:—Vocalists: Miss Rosa Dallow (soprano), Miss Helen Blain (contralto), Mr. Samuel Masters (tenor), Mr. Denis O'Neil (Irish baritone). Songs at the piano: Miss Josephine La Barte. Sketches at the piano, Mr. Cooper Mitchell. Pianoforte soloist and accompanist: Mr. Wm. Every, F.R.C.O., L.R.A.M., and a string orchestra.

How to Advertise Gas.—The false statement to the effect that the Society of Medical Officers of Health has given up electric lighting in favour of gas continues in circulation in the provinces. Only in the meeting and exhibition rooms has gas been adopted, and in our issue of November 4th we stated that we had strong grounds for believing that it was put in merely as an advertisement. We challenged proof to the contrary, but none has been received; we conclude, therefore, that our inference was correct. Yet the *Gas World* of November 12th has the hardihood to quote a statement of a provincial doctor implying that gas had been installed in the building in preference to electricity. We suggest that station engineers who meet with this damaging misstatement in the local papers should expose it at once.

The Sedneff Accumulator.—The German newspapers are directing attention to the Titan Electric Co. as a result of efforts which are being made in Paris to find a market for the company's shares in Germany. According to a Cologne newspaper, a Paris Stock Exchange newspaper, in connection with the "bank" of the Union Centrale, is flooding Germany with circulars strongly recommending the purchase of shares in the Titan Electric Co., which claims to produce the best accumulator in the world. The company was formed in London three months ago, with a capital of £80,000. The £10 shares, it is said, are mostly only paid to the amount of £1, and the fully paid shares were sold at £8. In the meantime, the shares have actually been quoted in Paris at 305 to 310 fr. (£12 4s. to £12 8s.).

The wild propaganda of the Paris newspaper for the company's shares in Germany has also evoked the criticism of a Frankfort newspaper, which has received a letter on the subject from trade circles. The letter states that, in order to prove that the Sedneff accumulator system surpasses everything existing, curves are given which must awaken in the lay mind the impression of complete superiority of this battery over all other systems. In reality, these are completely meaningless. The puff is supported by the favourable report which is said to have been given by a leading German electrotechnical firm and the text of which is added. According to an inquiry which has just been made of the firm in question, batteries on this system were tested in 1898-9, but the firm, so far as can be ascertained to-day, made no expert report on the subject.

A further reference to the question is made by a second Frankfort newspaper, which, as the French propaganda is chiefly based upon an alleged report by the Siemens & Halske Co., applied to the latter for information on the subject. The company, whilst admitting that the Sedneff accumulator was tested at its works once in 1898, states that the data published in the alleged expert report do not agree with the results of the tests entered in the S. & H. records. The alleged report cannot therefore have been made by the firm; in any case, no copy of an expert report on the Sedneff accumulator is to be found in the company's records. It is added that a copy of this alleged report reached the company from another quarter in 1908, and the S. & H. Co. at the time lodged a protest with the Paris office of the Sedneff Accumulator Co. against the employment of the report, whilst a further protest has now been made as a result of the present publication.

A Paris dispatch of November 4th announced that the shares of the Titan Electric Co. had been offered in vain for some days past, and without any quotation.

Scott's Old Boys.—The annual reunion of "Scott's Old Boys" was held on Saturday evening at the "Villa Villa" Restaurant, Gerrard Street, W., under the presidency of Mr. C. N. Russell (Shoreditch). We understand that these reunions, which are marked by extraordinary enthusiasm, are attended by members from all parts of the country. The dinner was followed by speeches and general conviviality, with some excellent entertaining by Miss Ruby Wilson and Mr. Wilson James. The society, which is informal, consists of men who were apprentices or pupils at "Scott's" Works, Hammersmith and Acton, in the eighties and early nineties. Many of the "Old Boys" have attained eminence in the electrical profession, whilst others have been less fortunate, but on these occasions all meet as in the old days, upon terms of absolute equality. The secretary, Mr. H. Marryat, 28, Hatton Garden, E.C., will be glad to hear of the addresses of any such with whom he may not be already in communication.

Electric Haulage on Canals.—Experiments on electric haulage carried out some months ago by the Compagnie Générale Electrique de Nancy have given favourable results, and the Chamber of Commerce of Nancy has decided to equip some kilometres of canal in order to ascertain the economic results that may be expected from its adoption. The company has agreed to apply its system to the Mauvages tunnel for Messrs. Fougerolle, of Paris, who are about to commence repairs to the tunnel which are expected to take seven years; the equipment will extend over a length of more than 6 km., and will be capable of towing lighters containing passengers at 8 km., or trains of loaded barges at 2 km. per hour. The installation will be at work early next year, and will be of great interest.

Appointments Vacant.—Borough electrical engineer for Limerick (£200), "A knowledge of the Irish language and Irish history on the part of the candidates will be considered an additional qualification." Professor of electrotechnics at the South African School of Mines and Technology, Johannesburg. See our advertisement pages in this issue.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS.—The opening meeting of the session took place on Thursday, last week, when Dr. Kapp, the retiring president,

welcomed those present to their new home, and on his suggestion, a hearty vote of thanks was accorded to the Institution of Civil Engineers for the use of their building in Great George Street for so many years. Col. Crompton briefly referred to the past history of the Embankment building and to the work of the International Electrotechnical Commission in obtaining international uniformity in electrical expressions and symbols and the standardisation of designs, &c. Dr. Kapp then distributed the premiums and prizes awarded for papers during the preceding session, and subsequently called on Mr. Ferranti, the new President, to take the chair—a proceeding which called forth enthusiastic applause. A vote of thanks to the retiring President was proposed by Col. Crompton, who referred in eulogistic terms to the work carried out by Dr. Kapp during the past year and to his attainments in electrical matters. Mr. W. M. Mordey seconded the vote in a brief speech, after which Mr. Ferranti delivered his address, a report of which appears elsewhere in this issue.

Institution of Electrical Engineers (Glasgow Local Section).—On Tuesday last week the chairman, Mr. Sam Mavor, delivered his inaugural address on "The Power Equipment of Collieries."

Institution of Electrical Engineers (Yorkshire Local Section.)—On Wednesday, Mr. T. Harding Churton delivered his inaugural address as chairman, at Leeds University, dealing with a variety of subjects relating to the electrical industry.

Faraday House Old Students' Association.—The annual Smoking Concert will be held at the Holborn Restaurant (Council Room) to-night, Friday, November 18th, at 8 for 8.30. Mr. Reginald S. Downe, M.I.E.E. (President), will take the chair, and advantage will be taken of this occasion to make a presentation to Mr. Howard Foulds, the late honorary secretary and treasurer of the Association.

On Monday next, November 21st, Mr. Alfred Hands, M.I.E.E., is to give a lecture on "Lightning," at Walthamstow Library—one of a series of lectures organised by a local committee. Entrance is free, or by programme, price 2d.

On Monday Sir Oliver Lodge lectured to the members of the Midland Institute on the "Electrification of Crops."

The Iron and Steel Institute.—The secretary has issued a circular relating to the Andrew Carnegie Research Scholarship, which is to be awarded annually to candidates of any nationality or either sex, under 35 years of age. Special forms must be applied for before the end of February. The object of the scheme is to enable students who have passed through a college curriculum or have been trained in industrial establishments to conduct researches in the metallurgy of iron and steel and allied subjects, with the view of aiding its advance or its application to industry. Secretary, Mr. G. C. Lloyd, 28, Victoria Street, S.W.

Royal Society of Arts.—On Wednesday last Sir J. C. Lamb, chairman, delivered his inaugural address, in which he described the part played by the Royal Society of Arts in the development of telegraphy. The electric telegraph first came before the Society in 1843, when Cooke and Wheatstone's system, as used on the Great Western Railway, was described and illustrated by a complete telegraph at work. Afterwards papers were read by Sir William Siemens, Prof. David Hughes, and others, and Cantor lectures by Prof. Fleeming Jenkin and Sir William Preece. Sir John Lamb described in detail the efforts made by the Society, mainly at the instance of Mr. Edwin Chadwick, which resulted in the transfer of the telegraph service from private companies to the Post Office, and finally he showed how the institution of sixpenny telegrams in 1885 was largely due to the energetic action of the Society.

Displaced Trolley Pole.—At Stockton County Court on 15th inst., before Judge Templer, a claim for damages was brought against the Imperial Tramways Co. by Robert Thirlway, a barman, who claimed £60 3s. 6d. for personal injuries and damages caused by the trolley pole on a tramcar coming out of its socket, striking him on the head and causing concussion of the brain. The defendants admitted that the trolley pole struck the plaintiff, but contended that they were not liable as no negligence had been proved. At the end of the hearing, his Honour said it appeared that something ought to be done to prevent the possibility of such an accident, otherwise persons using the cars would not have that sense of security to which he thought they were entitled. He hardly thought the accident could be said to be unavoidable, and he thought where a company had the monopoly of the road, it was necessary that passengers on the cars should be protected in every possible way. He awarded the plaintiff £40 and costs.

The Scottish Tramway Officials' Association.—There was a representative turn-out of Scottish tramway officials at Ayr on Monday, November 14th, when the sixth meeting of their Association was held. On behalf of the Ayr Corporation the company was welcomed by Provost Hunter and Bailie Ferguson (Convener of Tramways Committee). An interesting item on the agenda was a discussion of "Transfers, their Use and Abuse." After all had expressed their views on the subject, the opinion of the gathering was that where halfpenny fares existed there was no need for transfers, and on many undertakings where the halfpenny fare system was in vogue it would be impossible to work them. After the business, the company was entertained to lunch by Provost Hunter and Bailie Ferguson, and then had a run over the Ayr system.

Extension of Devonport Dockyard Power Station.—A lecture was given on Thursday, October 20th, at Devonport, by Mr. Z. H. Kingdon, to the Electrical Fitters' Association on the above. The extension is due to the extra demand for power and lighting at the North Keyham Yard. The original design of the station included 14 Babcock & Wilcox boilers and 9 generating sets, with a total output of 5,100 kw. The installation prior to extension consisted of nine boilers and six generating sets, with a total output of 3,500 kw. As it was impossible to extend the site of the station without great inconvenience, it was considered advisable not to complete the original design, but rather to install a type of machinery which would give a maximum output and occupy a minimum of space, and it was finally decided to install two Clarke, Chapman (Woodeson's patent) boilers, evaporating 18,000 lb. of water per hour each, and two sets of Willans and Robinson (Parsons type) high-pressure turbines, of 1,200 kw. each. This extension leaves space sufficient for three other similar sets; hence the total output of the station on completion will be 9,500 kw.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Lancaster T.C. has decided to appoint Mr. Geo. C. Milnes, A.M.I.E.E., chief assistant at the electricity works, as assistant engineer until the departure of Mr. Tester, electrical and tramways engineer, at a salary of £130 per annum, and after Mr. Tester leaves to appoint him the temporary engineer at a salary at the rate of £150 per annum for six months on probation.

The Stamford staff of the Urban Electric Supply Co. has presented a Gladstone bag to Mr. Hugh Holmes, who is leaving to take up an appointment with Messrs. Chamberlain & Hookham, of Birmingham.

On Monday last, at St. John's Church, Bigrigg, near Whitehaven, Mr. H. P. Baynham, chief assistant engineer, Whitehaven Corporation Electricity Works, was married to Miss E. Lancaster, of Moor Row, Cumberland. On the previous Saturday he was presented by the electricity works staff and workmen with a marble clock and pair of bronzes. The borough electrical engineer, Mr. B. Sankey, made the presentation.

Mr. D. D. Watson has resigned the position of mains superintendent to the Kent Electric Power Co., to take up the position of chief assistant to the Waterloo and City Railway.

General.—The marriage took place at Cairo on October 25th of Mr. Arthur Cyril Jennings, A.M.I.E.E., of the engineering department of the Telephone Co., of Egypt, and Miss C. H. Mackay, only daughter of Mr. Chas. Mackay, of Port Elizabeth. Mr. Jennings was formerly at Margate and Canterbury with the National Telephone Co.

Mr. C. D. Greenhalgh, electrical engineer to the Malvern U.D.C., has been appointed electrical engineer to the Rainhill County Asylum, Liverpool, by the Lancs. Asylums Board.

Mr. Wm. H. Booth, F.G.S., announces that his City address is Room 38, Broad Street Avenue, E.C. Telephone 3566 London Wall.

It is announced that Mr. H. Harmsworth and Mr. H. Cecil Walker have joined the board of R. Waygood & Co., Ltd.

On Saturday last, the twenty-fifth year of Prof. Sir J. J. Thomson's occupation of the Cavendish Professorship of Experimental Physics, was signalised by a gathering of scientists at the Cavendish Laboratory, when a volume, entitled "A History of the Cavendish Laboratory. 1871-1910," prepared in honour of the occasion, was presented to Sir J. J. Thomson by Dr. Glazebrook. The book contains a record of the work done in the famous laboratory, and of the scientific men who have worked there. The chair is unique in having been held by three so celebrated men as Clark-Maxwell, Lord Rayleigh, and the present holder. Many famous scientists contributed to the contents of the book.

Obituary.—Mr. G. H. Brougham Glasier.—We regret to announce the death, which occurred on November 11th at 31, Cromwell Road, London, S.W., of Mr. G. H. Brougham Glasier, deputy chairman of the Charing Cross, West-End and City Electricity Supply Co. The deceased gentleman was also deputy chairman of the Suppliers' Construction Co., Ltd., chairman of the Kent Electric Power Syndicate, Ltd., and a director of the Derbyshire and Nottinghamshire Electric Power Co. Mr. Glasier was 70 years of age.

NEW COMPANIES REGISTERED.

International Railophones, Ltd. (112,503).—This company was registered on November 2nd, with a capital of £10,000 in £1 shares, to carry on the business of electricians, telegraph and telephone makers and operators, &c., and to adopt agreements with Railophones, Ltd., and H. von Kramer. The subscribers (with one share each) are:—A. Stewart, Palace Chambers, Bridge Street, Westminster, electrical engineer; E. L. Wellford, Stock Exchange, E.C., stock and share dealer; H. von Kramer, 21, Croad End Road, Erdington, Birmingham, electrical engineer; E. Hirst, 13, Broadhurst Gardens, London, manager; E. Wilson, Glynn Wynne, Penns Lane, Erdington, accountant; T. Duckitt, 14, Hillaries Road, Gravelly Hill, Birmingham, electrical engineer; W. Pike, 283, Belgrave Road, Birmingham, clerk. Minimum cash subscription, 10 per cent. of the shares offered to the public. The number of directors is not to be less than two or more than five; the first are H. von Kramer and A. Stewart; qualification, £50; remuneration, 7½ per cent. of the net profits, divisible. Registered office, Prudential Buildings, Corporation Street, Birmingham.

Accessories Manufacturing Co., Ltd. (112,564).—This company was registered on November 7th, with a capital of £5,000 in £1 shares (4,900 pref.), to carry on the business of electricians, manufacturers of and dealers in electrical accessories, electrical fittings, electrical goods and supplies, &c. The subscribers (with one share each) are:—A. A. White, 298, Thorold Road, Ilford, traveller; J. M. Douglas, 11, Dean Street, Oxford Street, W., electrician. Private company. The number of directors is not to be less than three or more than five; the first are A. J. L. Ball, J. M. Douglas, A. A. White and C. E. Ball; qualification, one share. Registered office, 11, Dean Street, Oxford Street, W.

English Electrical Co., Ltd. (112,639).—This company was registered on Novemcer 10th, with a capital of £5,000 in £1 shares. to carry on the business of manufacturers of and dealers in electrical, incandescent-filament lamps or other illuminating apparatus, electric engineers and contractors, suppliers of electricity, &c., and to adopt an agreement with the Midland Machine Trust, Ltd. The subscribers (with one share each) are:—E. Jardine, M.P., The Park, Nottingham; D. J. Jardine, The Park, Nottingham, machine builder; J. McConnell, 6, Southey Street, Nottingham, warehouseman. Private company. The number of directors is not to be less than two or more than six; the subscribers are to appoint the first; qualification, one share. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Auriphones, Ltd. (112,565).—This company was registered on November 7th, with a capital of £1,000 in £1 shares, to carry on the business of wholesale and retail suppliers of auriphones and other telephonic, electric, magnetic, galvanic or other apparatus, &c. The subscribers (with one share each) are:—W. M. Crowe, 82-5, Fleet Street, E.C., managing director; P. G. Wayne, A.M.I.C.E., 82-5, Fleet Street, E.C. Private company. Table "A" mainly applies. The first directors are W. M. Crowe and P. G. Wayne, A.M.I.C.E. Registered office, Byron House, 82-5, Fleet Street, E.C.

Salford Electrical Instruments, Ltd. (112,599).—This company was registered on November 8th, with a capital of £20,000 in £1 shares (10,000 preference), to carry on the business of manufacturers of and dealers in electrical measuring instruments, meters, wires, cables and other apparatus, &c., as formerly carried on by the General Electric Co., Ltd., of 71, Queen Victoria Street, E.C., at Bow Street Works, Adelphi, Salford, Lancs. The subscribers (with 10 shares each) are:—J. Y. Fletcher, 71, Queen Victoria Street, E.C., electrical engineer; T. J. Boorne, 71, Queen Victoria Street, E.C., electrical engineer. Private company. The number of directors is not to be less than two or more than nine; the first are M. Railing and F. Sells; qualification, 200 shares; remuneration as fixed by the company. Registered office, 67, Queen Victoria Street, E.C.

Rosario and Western Railway Co., Ltd. (112,580).—This company was registered on November 7th, with a capital of £1,000,000 in £1 shares, to acquire a concession granted in 1906 by the Legislature of the Province of Santa Fe, Argentina, to H. E. Tieman and Q. de Acevedo, for (*inter alia*) the construction and working of a railway from Rosario to Canada San Antonio, with sundry branches therefrom, to acquire, construct, equip, maintain and work railways, tramways, telegraph and telephone lines, &c., and to carry on the business of an electric light, power and traction company. The subscribers (with one share each) are:—C. Sofiano, 25, St. Mary Axe, E.C., gentleman; J. E. Tieman, 43, Grand Place, Antwerp, merchant; Q. de Acevedo, Machado calle San Lorenzi 1,236, Rosario, Argentina; P. B. Henderson, 24, Austin Friars, E.C., gentleman; F. P. Winterbotham, 6, Ladbroke Terrage, Notting Hill, W., gentleman; F. M. Johnson, 7, Cadogan Court, S.W., gentleman; H. M. Robinson, Lorne House, Oxton, Birkenhead, gentleman. Minimum cash subscription 100 shares, but no offer of the initial share capital to the public is intended; the number of directors is not to be less than two or more than nine; the subscribers are to appoint the first. Registered by Budd, Johnson & Jecks, 24, Austin Friars, E.C.

Consumers' and Assessees' Protection Society, Ltd. (112,610).—This company was registered on November 9th as a company limited by guarantee, with 20 members, each liable for £1 in the event of winding up, to protect the interests of householders and others with regard to the consumption and supply of water, gas and electricity, or the assessment and payment of rates and charges, &c. The subscribers are:—P. Stanley, 21, Palliser Road, West Kensington, W., technical secretary of an association; W. R. Hood, 8, Union Court, Old Broad Street, E.C., surveyor; J. F. Walker, 36, Basinghall Street, E.C., merchant; J. Cann, Athole House, Maple Road, Surbiton, J.P.; S. Low, Westminster House, Great Smith Street, S.W., publisher; J. Morgan Richards, jun., 46, Holborn Viaduct, E.C., merchant; W. R. Semken, 17, Penford Street, Myatt's Park, S.E., law student. The management is vested in a council. Registered office, 12, New Court, Carey Street, W.C.

Glantawe Electric Supply Co., Ltd. (112,615).—This company was registered on November 9th, with a capital of £10,000 in £10 shares, to carry on the business of proprietors of an electric light undertaking at Glantawe, Ystradgynlais, Brecon, or elsewhere in Wales. The subscribers (with one share each) are:—E. Lewis, Glais S.O., Clydach, Glam., mining engineer; E. J. Evans, Glais S.O., Clydach, Glam., provision merchant; R. Gwilyn, Glais S.O., Clydach, Glam., colliery secretary; J. Jordan, Glais S.O., Clydach, Glam., gentleman; D. W. J. Glyncoch, Clydach, Glam., farmer; M. E. David, Glen View, Glais, Clydach, Glam., railway official; W. J. Stephens, Bryneved, Sketty Road, Swansea, colliery proprietor. Private company. E. Lewis is the permanent managing director. Other directors to be appointed by the company; qualification, £200. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

Electric Safety Boiler Cleaner, Ltd. (112,686).—This company was registered on November 12th, with a capital of £25,000 in 20,000 7 per cent. participating preference shares of £1 each and 100,000 deferred shares of 1s. each, to carry on the business of cleaners and repairers of boilers, buildings, bridges and ships, &c. The subscribers (with one participating preference share each) are:—A. Murray, 6, Lloyds Avenue, E.C., consulting engineer; W. J. Jennings, 2, Netley Road East, Brentford; L. Pitches, 9, Edgecombe Road, Camberwell, S.E., clerk; B. Norman-Sinclair, 35, Westbourne Gardens, W., physician; H. Board, 13, Bruton Street, W., valet; J. Savage, 13, Bruton Street, W., manager of chambers; W. Comery, 6, Lloyds Avenue, E.C., engineer. Minimum cash subscription, 100 participating preference shares. The number of directors is not to be less than two or more than nine; the first are Lord Louth and S. D. Thomas; remuneration, £200 each per annum (chairman, £250). Registered by Marlow & Patey, 8, Regent Street, Pall Mall, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Spagnoletti, Ltd. (94,447).—Particulars of £12,500 debentures, created by resolutions of August 12th and October 22nd, and secured by trust deed dated October 22nd, 1907, filed pursuant to Sec. 93 (3) of the Companies' Consolidation) Act, 1908, the amount of the present issue being £2,000. Property charged: Goldhawk Works, Shepherd's Bush, W., and the company's undertaking and property, present and future, including uncalled capital. Trustees: J. E. Spagnoletti, Goldhawk Road, Shepherd's Bush, W.; and G. J. L. Nicholson, Albany Chambers, York Street, Westminster.

E.M.F., Ltd. (104,699).—Debenture dated October 15th, 1910, to secure £2,000, charged on the company's undertaking and property, present and future, except uncalled capital. Holder: W. Bein, 13, Clarendon Street, Warwick Square, N.

London Telegraph Training College, Ltd. (92,661).—A memorandum of satisfaction in full on October 20th, 1910, of debenture dated March 24th, 1909, securing £100, has been filed.

British Electric Traction Co., Ltd. (49,855).—Return dated July 1st, filed October 18th, 1910. Capital, £4,000,000 in £10 shares (200,000 preference); 161,437 preference and 133,301 ordinary shares taken up; £10 per share called up on 142,500 preference and 117,926 ordinary; £2,604,260 paid, in addition to £7 10s. on five shares forfeited; £343,120 considered as paid on 18,937 preference and 15,375 ordinary. Mortgages and charges, £1,946,383.

Aron Electricity Meter, Ltd. (58,650).—Return dated July 8th, filed August 24th, 1910. Capital, £250,000 in £1 shares (125,000 preference); 124,896 preference and 125,000 ordinary shares taken up; £1 per share called up on the preference; £124,948 10s. paid, including £52 10s. on 104 preference shares forfeited; £125,000 considered as paid on the ordinary shares. Mortgages and charges, £32,200.

Charles A. Day & Co., Ltd.—Second debenture dated October 18th, 1910, to secure £100, charged on the company's property, present and future, including uncalled capital. Holder: J. Welch, Hibel Road, Macclesfield.

Windsor Electrical Installation Co., Ltd. (46,186).—Deed of further charge and a debenture (as collateral security), both dated November 8th, 1910, to secure £4,500, charged on certain freehold and leasehold property in New Windsor, and the company's undertaking and property, present and future, including uncalled capital. Holders: Royal Exchange Assurance of the Royal Exchange, London.

CITY NOTES.

West India and Panama Telegraph Co., Ltd.

THE sixty-seventh ordinary general meeting of this company was held at Winchester House, E.C., on Wednesday, November 16th, Mr. W. B. Kingsford presiding.

In proposing the adoption of the report (see ELECTRICAL REVIEW, page 796), the CHAIRMAN said he had several satisfactory statements to make to the meeting. The revenue for the six months under review showed an increase of £4,963 over the corresponding half of last year. The traffic receipts were also encouraging, showing an increase of £4,649 for the corresponding period. This was partly accounted for by the increased trade with other Colonies. The traffic receipts just mentioned were the best the company had experienced for 20 years. The expense of repairs to cables was somewhat less, but the expenses of the stations rather more. In this connection he might mention that the cable ship *Henry Holmes* had been idle and laid up in harbour for two months, no repairs being needed, thus effecting a saving in coal, and a decreased expenditure in cable. They would notice that expenses were charged for 23 stations, against 21 in 1909. The two new stations at British Guiana and Trinidad were erected for the installation of wireless telegraphy. The result of the half-year's working was a balance of £21,240, which the directors propose to deal with as follows: £1,000 to reserve, payment of dividend on first and second preference shares, and a dividend of 1s. per share, free of income-tax, on the ordinary shares. This, he thought, was a matter for congratulation, as the ordinary shareholders had received no dividend since June, 1900, and might be taken as an indication that in the near future their prospects might be very much brighter. At the Royal Commission recently held to inquire into the relations of trade between Canada and West Indies and other places, he had given evidence with reference to telegraphic communication. The report of this Commission was now published in a Blue Book, and any proposals arising out of that report would be carefully watched by the directors in the best interests of the shareholders. It might also interest those present to know that Trinidad was the home of the famous Pitch Lake. Several companies were prospecting for oil in this region, and he believed a good beginning had been made. The shareholders would, no doubt, very heartily wish these companies success, because of the increased business likely to accrue to the company.

MR. HENRY HOLMES seconded the motion, and compared the early days of struggle with the present ones of prosperity.

The motion was then adopted.

In reply to votes of thanks to the directors, the CHAIRMAN said that unless unforeseen contingencies arose between now and December, all things pointed to a very prosperous half-year. A proposition from a shareholder that a sum be divided between the directors and staff in recognition of their services in bringing about the improved position, was deferred to a later meeting.

Castner-Kellner Alkali Co.—The directors' report for the year ended September 30th states that the net profit is £164,555, making, with the amount brought forward, £180,395. After deducting debenture interest and the interim dividend at the rate of 12½ per cent. per annum, there remains £143,284, out of which the directors recommend placing £32,500 to depreciation reserve, and £45,000 to the general reserve. £50,625 is required for payment of a final dividend of 11½ per cent., making 17½ per cent. for the year, and £15,159 carried forward. The debenture debt has been reduced from £250,000 to £200,499.

Eastern Telegraph Co., Ltd.

Sir John Wolfe Barry, K.C.B. (chairman), presided on the 9th inst. at Electra House, E.C., over the seventy-seventh ordinary general meeting of the above company.

In moving the adoption of the report (see page 755), the Chairman said the gross revenue for the half-year under review amounted in round figures to £664,500, as against, for the corresponding half-year of 1909, £592,600, or an increase of £71,900. The message receipts showed a satisfactory increase of £68,100 when compared with the corresponding period of 1909, and this improvement was spread over practically every branch of the traffic. This was satisfactory, as nothing of a politically untoward nature had happened during the half-year to account for the additional revenue, and the increase appeared to be due to general improvement in trade. Interest on reserve fund investments and on cash at bankers on deposit, &c., was £3,800 more this half-year than in the half-year to June, 1909. Turning to the expenditure side of the revenue account, the total expenses for the half-year amounted in round figures to £283,800, as against, for the corresponding period of 1909, £278,900, or an increase of £4,900. Expenses in London showed an increase of £850, and expenses at stations were £10,900 more than for the corresponding half-year of 1909. Of this latter figure about £4,000 was in respect of salaries and wages due to automatic promotion and a slight augmentation in the number of staff; the remainder of the increase was spread over practically all the items of expenditure included in this abstract. During the half-year expenses amounting to £5,400 were incurred in connection with the prolongation of one of their concessions from foreign countries. The items to which he had referred accounted for an increase in expenditure, when compared with the corresponding half-year, of £17,150, but, on the other hand, expenses attending maintenance of cables were £12,400 less this half-year than they were in the half-year to June, 1909, which was due to the circumstance that only 215 knots of cable were expended on repairs this half-year against an expenditure of 405 knots in the half-year to June, 1909. The increase in the message receipts had enabled them to meet the additional working expenses to which he had referred, to transfer to the general reserve fund £175,000, a sum rather larger than usual at the end of an interim half-year, and to carry forward nearly £60,000. On the subject of the general reserve fund, he would remark that, to those who had not followed the policy of the board, the importance of maintaining a large reserve fund might possibly not be fully appreciated, and, if this vital question was considered merely from a superficial standpoint, the amount at present accumulated might be thought by such persons to be unduly large. But stockholders who had been present at these meetings, or those who had either read his remarks or the remarks of his predecessors on the subject, would fully understand the need for substantial reserves in such an enterprise as theirs, and appreciate the comforting feeling of security which was thereby engendered. Rather more than ten years ago it was considered very important to strengthen their system between Great Britain and Australia by an alternative route *via* St. Vincent-Ascension-St. Helena-South Africa-Mauritius and Cocos Island. This scheme, together with other important cable requirements which developed about the same time, entailed the expenditure of a very large sum of money: but the financial burden was rendered bearable from the fact that the company, as well as the Eastern Extension Co., was able to draw largely upon its reserves. These new cables had materially helped them to hold their own against the Government subsidised cable across the Pacific, and preserve a larger share of the Australian traffic than they would otherwise have been able to do. In consequence of the substantial sums which they had been able to withdraw from reserve, the capital expenditure on account of cables during the last 10 years had only been increased by £350,000; whereas during the same period 2½ millions had been spent on cables, and the total so charged against reserve from the formation of the company to date amounted to no less a sum than £4,600,000. Just consider what the position of this company would have been had they distributed the whole of the surplus reserve instead of adopting the course which they had pursued. In order to meet the large expenditure, it would have been necessary to issue additional capital, often at inopportune times, and thereby creating a serious permanent charge against revenue. In that case, they had no hesitation in stating that the financial status of the company would have been very different from that upon which they had every reason to congratulate themselves to-day. The advantages of an ample reserve fund were many, not only to the stockholders, but to the Government and the telegraphing public as well. They were always in a position to maintain their system efficiently, and renew, when necessary, any portion which might deteriorate through age and other natural causes. When the latter operation was decided upon, cable of greater carrying capacity was substituted. Their reserves enabled them to reply to threatened or actual competition by other countries, a factor which would probably bulk more largely in the future than it had done in the past for the reason that some foreign Governments were no longer content to see the success of their companies without having cables of their own nationalities. As he had shown, the reserve fund had enabled them to increase the carrying and earning powers of their system, and had thereby made it possible to bring into force large reductions in rates, especially during recent years. So much had been said in the past on the subject of reserves, that it might appear he was unduly labouring the point; but he was imbued with its importance, and was convinced that the stability of the company was in a great measure due to the policy which had been pursued so consistently from the first, of maintaining substantial reserves. The associated telegraph companies could not stand still. They must "follow the flag." Sometimes negotiations dragged along slowly, but at other times matters developed rapidly, and they must be prepared to act promptly should occasion arise. It was so much easier to do so with success when they had the money at their command. They had in contemplation some important renewals on some of the older sections, the cost of which would be charged against the general reserve fund in the usual way. Whenever a repair was effected a certain amount of renewal work was done in the operation, but it was sometimes more economical to renew more extensively than was actually required to restore communication. This might be considered necessary as a preventive against the interruption of a particularly important section, or it might happen that the probable saving in the cost of future repairs alone might justify the larger expenditure. Owing to the further depreciation in British Government and British railway securities, they had considered it advisable to transfer an additional sum of £50,000 from the reserve fund as a "provision on account of investment fluctuations," making a total of £230,000. In conclusion, he was glad to say that the traffics continued satisfactory, and he did not think the company had ever been in a sounder position to carry out the requirements of the public than at the present time.

Sir John Denison Pender, K.C.M.G., seconded the motion, and it was carried without discussion.

The Marquis of Tweeddale and Sir J. Albert J. Leppoc Cappel were re-elected directors, and the meeting closed with a vote of thanks to the board and staff, proposed by Mr. Newton.

Western Union Telegraph Co.

The report for the year ended June 30th states (according to the *Financier*) that early in the year the executive committee appointed a special auditing committee to examine the accounts and accounting methods of the company, and authorised the committee to employ such expert assistance as it deemed advisable for that purpose. Acting under this authority, the auditing committee engaged Messrs. Price, Waterhouse & Co., with the assistance of engineering experts selected by them, to value the physical property and other assets, to check up the liabilities, and to recommend such changes as might be found necessary to bring the company's accounting system up to the best modern standards. A copy of the accountant's report has been mailed to each stockholder. This report shows that there has been no change in the outstanding capital stock during the year. The funded debt shows an apparent increase of $1,927,000, although, in fact, it has been reduced $2,000,000 by the purchase of that amount of the company's 4 per cent. convertible bonds. The increase, as shown, is due to the fact that bonds of subsidiary companies, assumed or guaranteed by this company, to the amount of $7,000,000, less held in the treasury $3,043,000, making a net outstanding obligation of $3,957,000, have not, heretofore, appeared as a liability in the reports of the company. While the surplus has been reduced by charges made against it, as explained in the report of Messrs. Price, Waterhouse & Co., the assets of the company are substantially in excess of its outstanding capital and debt, and provision has been made for cable reserve and contingent liabilities not heretofore taken into account The number of messages transmitted during the year was the largest in the history of the company, and shows an increase of 7,081,966 over the number sent during the previous fiscal year. The increase in the number of offices was 504. There was added during the year 2,487 miles of pole and cable mileage, and 46,549 miles of wire, of which 30,515 miles were copper. The total wire mileage is now 1,429,049, of which 530,517 miles are copper. On December 15th, 1909, a contract was made between the company and the American Telephone and Telegraph Co., providing for the joint use of plant and operating facilities, which will, when fully worked out, add greatly to the efficiency of the service and economical operation of both companies. The dividend has been continued at 3 per cent., because, in the opinion of the directors, no change should be made in this rate until it is determined what, if any, further charges should be made on account of depreciation or reconstruction, and until such rearrangements and improvements in the property shall be made as will enable new improved and extended facilities to be given to the public.

May-Oatway Fire Appliances, Ltd.—The accounts for the year ended December 31st, 1909, show a loss of £2,308, a result which is, the directors state, mainly due to restricted business consequent upon the severe competition the company has had to contend with. According to an abstract of the report in a financial daily, with a view to minimising the present competition, and also to strengthening the position of automatic fire alarms as a whole, negotiations are in progress for the amalgamation of the principal alarm companies.

R. Hornsby & Sons, Ltd.—The directors recommend a dividend on the ordinary and new shares for the year ended September 30th, 1910, at the rate of 6¼ per cent. per annum, less income-tax, placing £15,000 to reserve, £1,000 to extensions fund, and carrying forward £4,392.

Continental.—France.—The balance-sheet of La Société Industrielle des Telephones, of Paris, for the last financial year shows a profit of £67,651, as compared with £78,032 in the preceding 12 months.

Germany.—The Berliner Electricitätswerke Gesellschaft, of Berlin, reports a net profit of £492,469 for the last financial year—an increase of £82,643 over the preceding 12 months.

Edison and Swan United Electric Light Co., Ltd.

MR. HENRY WOLFENDEN (chairman) presided on Thursday last week, at Winchester House, E.C., over the twenty-seventh annual meeting of this company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 754), said the result of the year's trading had been to the board, as it must be to the shareholders, of a disappointing character, but the explanation was not far to seek. Briefly it lay in the fact that the manufacture of electric incandescent lamps, which was their main business, had been revolutionised during the past few years. The carbon lamp had been largely superseded by the metal-filament lamp, and naturally they had had to adapt themselves to the new order of things, and this had been a long and costly procedure. In the first place, the selling price of carbon lamps had suffered in view of the generally-reduced demand for this type, and consequently the profit attending their manufacture and sale had necessarily dwindled. He might just say, however, that in point of numbers they had not felt the reduced demand so keenly, perhaps, as some of their competitors, seeing that their sales in number, had remained stationary in comparison with those of the previous year, but the money realised was 13 per cent. less. They had materially reduced their stocks of carbon lamps during the year. In the second place, the difficulties attending the production of a new and costly type, such as the metal-filament lamp, had been great. During the year under review, they had done much valuable work in successfully overcoming their final difficulties, and now their production of these lamps was both large, and of the highest quality, and they were giving every satisfaction to users as was shown by their receiving repeat orders of increasing magnitude constantly. During the earlier part of the year, however, the costs of production were very high, but in the case especially of a new manufacture, this was almost inevitable. Much work of an experimental character had had to be done, and the cost of this had had to be borne out of revenue. Strenuous efforts, however, were made to reduce these costs, and he was glad to say they had been successful in this direction. In fact, they might now congratulate themselves on being in a position to produce the best quality of lamps in large quantities at a very reasonable cost indeed, regard being had to the expensive nature of the article dealt with. Unfortunately, the year under review did not derive its share of benefit from these lamps, and, as he had said, they were disappointed, and the more so as, in their previous year's report, they ventured to look forward to a remunerative trade in the future. They did not, of course, indicate any particular year, or the year ending June last, as the year in which that improvement would crystallise, but they now ventured to express the hope that the current year would reap full advantage of the steps they had taken and would show a marked improvement as a consequence, judging from the results produced in the months which had elapsed since the close of the financial year, which had been of a very satisfactory character. As to the prospects of a demand for metal-filament lamps, they thought the field for their use should be a widely expanding one, owing to the economic result from their use and the improved light they gave. These facts should largely extend the use of electricity, and so increase the demand for lamps. One special direction in which the demand should be very large was high candle-power lamps, which were now being introduced. These ought largely to supersede arc lamps and gas for street lighting and for large spaces, whether outdoor or indoor. They were producing these lamps in all candle-powers up to and including 1,000 candles. In addition to the lamp business they manufactured and sold fittings and accessories, and many other articles. The value of their turnover in these had kept up and showed a slight increase on the previous year, and this increase had been accentuated since the close of the year. Turning to the net revenue account, they had made the same allocations as in the previous year to depreciation of buildings, plant and stock, although this had involved some reduction in the carry forward. In the balance-sheet, on the liability side, they would notice two lines reading "5 per cent. second debenture stock, £100,000 issued as security against loans." This seemed very formidable, but was not so in reality. Their loans were not increased beyond the figures shown in the previous year, but, on the contrary, they showed a reduction. They would also notice that creditors' balances were £52,704, against £53,175 in the previous year. When the loans were paid off this debenture stock would, of course, come back into their possession. On the asset side of the balance-sheet the freehold and leasehold property and plant showed little variation, but were slightly up; and their expenditure on capital account, which was given at about £5,000, would now be a decreasing figure. Their stocks were lower, being £169,864, against £167,767 last year, a decrease of £6,803. Their debtors were up by £4,889, being £55,900, against £51,011 last year. The investments were reduced, owing to some debentures they held having been paid off at a slight premium. The market value of the remaining investments was £400 to £450 below the sum at which they stood in the balance-sheet, but they anticipated that later on this deficiency would be made up. Their interest in the Altrincham Co. remained practically unchanged, and they regarded this as a very valuable and important asset. It was paying a 7 per cent. dividend, and so far as they could see they looked forward to a continuation of that. In conclusion, he might say that, if no new discovery of an unexpected nature arose, they looked forward to being able to meet the shareholders next year with figures of a much more favourable and encouraging character, and meanwhile he could only ask them to exercise patience and confidence, which he believed would soon earn their reward.

MR. E. B. ELLICE CLARK seconded the motion.

MR. WATSON remarked that, in common with other shareholders, he was disappointed at the report, but the Chairman had given a most reasonable explanation, and it was apparent to him that they were going on the right road to prosperity.

MR. LEA SMITH said everyone who knew anything about electric light was aware of the great changes which had taken place, and it took time to get over these changes. Therefore, although the shareholders were not doing well, he thought they ought to attend the meetings and show their sympathy with the board.

MR. CROSS asked how much of the stock represented the old carbon lamps. He also said that a rival company appeared to be going ahead and their lamps were fitted in the room they were meeting in.

The CHAIRMAN said the stock of carbon lamps had been considerably reduced, but he had not the figures of the different stocks before him, but the only increase in stock had been in the metal-filament lamps, which, of course, was necessary. Every effort was being made to push the sales, and they were increasing week by week. They were satisfied with the rate of progress being made.

The report was then carried, and the retiring director re-elected.

Cleveland and Durham Electric Power, Ltd.

AN extraordinary general meeting was held at the Station Hotel, Newcastle, on November 14th, for the purpose of confirming the resolution passed at the last extraordinary meeting. This resolution reduced the capital of the company from £1,000,000 to £700,000. Mr. Falconer, M.P., presided.

The CHAIRMAN formally moved the motion and MR. HOBART ARMSTRONG seconded.

MR. GEMMELL said that before the resolution was put he should like a little more information regarding the relations of the Tyneside Electric Development Co., Ltd., to that company. In the statement issued to the shareholders it was said "the debenture-holders were friends of the company and were represented by the Tyneside Electrical Development Co., Ltd." What did that mean? Was the Tyneside acting purely as friends in need, or was it to derive any benefit or consideration from that company, and was it to exercise any control over that company on behalf of the debenture-holders?

The CHAIRMAN explained that the Tyneside Development Co. were the trustees for the second debenture-holders, and exercised all the functions which trustees generally exercised. The company necessarily received all the information with regard to the power company which trustees for debenture-holders were usually entitled to. They had not, in fact, exercised any control. The costs of the trustees were paid by the company, as they always were in the case of trustees. They were simply discharging the duties which were usual in such cases.

MR. GEMMELL said he did not think the answer was satisfactory. Proceeding, he said he did not think the scheme was adequate, but that its terms were too onerous, being, as they were, close upon 7 per cent. for the money to be received. In view of the proceedings at the last annual meeting, at the first meeting on October 25th, and the chairman's want of frankness at that meeting, he intended to vote against the scheme in its entirety as a protest against the financial, commercial and technical policy, which, in his opinion, had brought about the present crisis.

The motion was then put and carried, with one dissentient.

A separate meeting of the deferred shareholders was then held, the Hon. Mr. James presiding, when the following resolution was carried unanimously:—

That this meeting hereby confirms the agreement dated October 24th, 1910, and expressed to be made between the said company of the first part, Francis McBain on behalf of himself and all other the holders of the deferred shares in the capital of the company of the second part, William Spicer on behalf of himself and all other the holders of the ordinary shares in the capital of the company of the third part, and John Hobart Armstrong on behalf of himself and all other the holders of the preference shares in the capital of the company of the fourth part, and declares that the said agreement and the special resolutions of the said company therein mentioned are to be binding upon the holders of the deferred shares in the capital of the company.

The ordinary shareholders met under the presidency of Mr. Falconer, and passed a resolution in essentially similar terms.

At the meeting of the preferred shareholders a resolution similar to that adopted at the other meetings, was moved by MR. FALCONER, seconded by the HON. MR. JAMES, and carried with one dissentient.

The CHAIRMAN, at the conclusion of the business, said that he thought it right to say a word with regard to the question of remuneration of the engineers, which was raised at the last meeting, when it was not in order. That remuneration was originally fixed with the engineers on behalf of the board by the late Sir John Milburn and himself. They realised that in the enterprise upon which they were entering, it was essential that they should have the engineering thoroughly efficient in every respect, and that in carrying out a system which in many respects was new, and which had to be carried out on a large scale, they should have the engineering staff fully and efficiently provided for. They accordingly stipulated with the engineers that there should be certain special members of the staff entirely set apart for the purpose of the Cleveland and Durham Co., and they also stipulated that certain other payments should be made in connection with the engineering. In addition, they stipulated for the assistance of the engineers not only in the designing and supervising of the work, but they had their assistance in regard to the general policy of the company, and in regard also to the various agreements they had had to make. The making of agreements, in connection with

a company like that, with other companies and with consumers, was almost as difficult as the engineering of the plant. They must find a method of suiting the requirements of every consumer, and of framing an agreement which would be perfectly fair to the consumer and to the company, and that was a task of no little difficulty. In connection with all the various agreements they had made, they had had the assistance of the engineers. That was the scope of the engineering assistance which they had had from their officials, and what they had paid to them extra was in respect of cases where they insisted upon special engineering assistants being got and devoted entirely to the company outside the ordinary engineering construction. While those assistants were responsible to the engineers, the engineers did not make any profit out of their labour, for which the company paid. Apart from that, the basis of the agreement with the engineers was that they received 5 per cent. upon capital expenditure, but they provided all the staff necessary for the designing and carrying out of the work, they paid their own travelling expenses and everything else. Sir John Milburn and himself thought they had made a very hard bargain with the engineers, and both of them had considerable experience in connection with such arrangements. He had asked the engineers to allow him to examine the amount of remuneration they had received for their professional services, apart from their expenditure on their staff and other office expenses. They had received from them in all, over and above all outside expenses to which he had referred, the sum of £14,127, and they had paid out of their pockets £9,294, leaving as a total remuneration, for 4½ years of their professional time, the sum of £4,900. In connection with that they had had practically the exclusive work of Mr. McLellan, one of the partners, who had resided in Middlesbrough for the greater part of that time, and had devoted himself entirely to that work; and having regard to the magnitude of the enterprise which they had engineered—a great part of which was in connection with the utilisation of waste heat—and having regard to the other work they had given in connection with the company's agreements, and general policy, he did not think anyone would, for a moment, say that a remuneration at the rate of a little over £1,000 per year was anything but what he had described it at the last meeting—a very moderate remuneration indeed. He might also add that their engineers held stock between them to the extent, he thought, of £5,300, so that any suggestion such as was made at the last meeting that those engineers had been reaping a benefit at the company's expense, and that the company was being run for their benefit, was absolutely unfounded. The problem the engineers had to deal with was much greater than the harnessing of a waterfall and the turning of it into power. The collecting of the waste heat of a large area and its utilisation in such a system as theirs was one of the engineering feats of the present day. There was no other area in which the same thing had been done, and, he thought, it would be a very ill return that the shareholders would make to those engineers if they allowed the suggestion to be made that, so far as they were concerned, there was anything on their part excepting an acknowledgment of the gratitude which they owed them. These were the facts, and he thought it well, especially as the remarks made at the last meeting were published in the Press, to take that first opportunity of putting them before the shareholders of the company.

Mr. Spicer moved, and Mr. Gemmell seconded, a vote of thanks to the chairman.

Western Telegraph Co., Ltd.

The seventy-fourth ordinary general meeting was held on the 9th inst. at Electra House, Finsbury Pavement, Sir J. Wolfe Barry, K.C.B. presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 754), said that the continued development and progress in the commercial conditions of the great countries of South America were very remarkable, and the report and accounts would have shown them that the company had shared in the general prosperity. Their system of submarine cables had been of much service to those countries in affording adequate means for speedy and accurate communication with the rest of the world. Comparing the accounts with those for the corresponding period of last year, the message revenue showed an increase of £44,000. The net revenue was increased by about £45,000. The cost of administration of the stations abroad was higher by £14,100. This increased expense had taken place in the following items: In salaries and wages, due to a larger proportion payable in connection with the joint station in Buenos Ayres, in annual promotions and extra clerical labour at their other offices, in expenses of training operators and passages of extra staff, and in electrical instruments and apparatus. They had increased repairs to buildings, including an amount paid in lieu of reinstating their former offices in Rio de Janeiro on the termination of the lease, and alterations to the offices in Buenos Ayres and other places. The rise in the rates of exchange in Madeira, St. Vincent and Brazil had also added to their expenses. The working expenses increased by £15,097. Much of this extra cost was, he hoped, of a non-recurrent nature, although it must be admitted that working expenses appeared to be increasing in all the countries served by the company, and also in other countries. After providing for debenture stock interest and income-tax, there remained a balance of £230,034, plus the amount brought forward, making a total of £236,043, which was to be dealt with as stated in the report. Although considerable sums had been transferred from revenue to the general reserve during the last 12 months, the total of that fund was now about £385,000 less than at June 30th last year, owing to the withdrawal during the 12 months of nearly £700,000 for new cables, &c. Another cable was being now manufactured, and would, he hoped, be laid between St. Vincent (Cape Verd Islands) and the Island of Ascension by the end of next month at a cost of something over £300,000. At the general meeting in November last year he mentioned that negotiations were being conducted with the Government of Brazil for the submersion of a cable between Ascension and Rio de Janeiro. These negotiations had not yet been brought to a successful conclusion, but should they be so the cost of that cable would amount to over £300,000 They had thus in view very considerable demands on their reserve fund at no distant date in order to keep abreast of the necessities of their traffic. It was to be borne in mind in connection with future revenue that the company had made a reduction in their tariff of 75 centimes per word between Argentina and countries outside South America in consideration for certain privileges contained in the concession recently granted the company by the Argentine Government. This reduction had only affected one month out of the six months under review, but amounted to a considerable sum. It was, of course, to be hoped that the reduction might be partly met by increase in traffic. It was further to be remembered that before many months elapsed they would have to encounter the competition of the German cable between the Canaries, West Africa, and Pernambuco, which it was expected would be laid in February next. For some considerable time the board had been endeavouring to secure a suitable building or site in Buenos Ayres for offices in lieu of those which they at present occupied as tenants upon a precarious tenure and which did not now meet their requirements. Several properties were offered to their agents at prices which equalled and in cases exceeded those ruling in the City of London, and they were advised that it was probable that the value of land in the commercial quarter of Buenos Ayres would continue to increase rather than decrease. Ultimately they had lately secured a good site, occupied by an old building, in the mercantile part of the city. It would be necessary to remove the existing house, and it was their intention to erect a building which would not only provide ample accommodation for their growing needs but enable them to let out a portion to suitable tenants, and they hoped that the rents received would assist in yielding a fair return upon the outlay, which was roughly estimated at £75,000. In order that cable-repairing steamers might be enabled if necessary to communicate with other vessels and with radio-telegraphic stations ashore, the Associated Cable Companies decided to install wireless apparatus upon their vessels, and the cable steamer *Norseman* was recently so fitted. This system of communication might at times prove extremely valuable to vessels needing assistance and possibly in the saving of life, while promising to be useful to their ships and the public.

Sir John Denison-Pender, K.C.M.G., seconded the resolution.

Mr. George Ennis congratulated the board upon the successful manner in which they continued to carry on the company, and said it was a matter of great satisfaction that their finances were in such a condition that they could easily afford to take nearly half a million from the reserve fund.

The report was adopted.

Prospectus.—*British Insulated and Helsby Cables, Ltd.*—This company has this week been offering for subscription (the list was to close yesterday) an issue at par of £200,000 5 per cent. mortgage debenture stock, part of an authorised issue of £500,000. This issue will form a floating charge upon the whole of the undertaking and assets, subject only to the existing issue of £500,000 4½ per cent. first mortgage debenture stock. The prospectus states that since the amalgamation of the British Insulated and the Telegraph Manufacturing Companies in 1902 the operations have been largely extended, and the present issue is made "in view of the present and future requirements of the business."

Canadian Electrical Combine.—The *Financier* recently stated that the proposed amalgamation of the Montreal Street Railway Co. with the Canadian Light and Power Co. had been agreed to without opposition. "A circular recently issued by the Montreal Street Railway Co. to its shareholders recommended a close working arrangement with the Montreal Light, Heat and Power Co. and the formation of a holding company into which the securities of the two companies would be exchanged. To carry out the project it was necessary that at least 51 per cent. of the stock of both companies should be voted, and evidently the necessary majority has been forthcoming."

Provincial Tramways Co.—The accounts for the financial year ended September 30th, 1910, subject to final audit, have been submitted to the directors, and they will recommend a final dividend of 9d. per share on the ordinary £1 shares. This, with 8d. per share paid in June last, will make a total of 1s. 5d. per share. The directors have set aside £8,000 for reserve and depreciation in respect of various undertakings the property of the company, and have set aside £350 towards writing off the expenses of the issue of the debenture stock and £217 the costs and expenses of the reduction of the ordinary capital. The balance to be carried forward will be £2,831.

Anglo-Portuguese Telephone Co., Ltd.—The directors have declared an interim dividend at the rate of 8 per cent., free of income-tax. Dividend warrants will be posted on November 30th.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	* £	No. of wks.	Total to date. £	* £	Route miles open.	Inc.
Aberdeen	Nov. 9	2,633	+ 111	23	34,383	+ 155	..	..
Ayr	„ 12	370	+ 1	26	9,637	+ 354	8	..
Bath	„ 12	1,380	+ 9	45	37,087	+ 1,943	..	..
Belfast	„ 11	8,312	+ 716	32	13,668	+ 7,875	37	..
Birkenhead	„ 13	2,211	+ 225	32	36,042	+ 839	13·6	..
Birmingham Corp.	„ 5	14,108	+ 601	31	212,474	+ 3,765	56·7	..
Blackburn	„ 9	1,967	— 97	32½	35,571	— 1,180	14·12	·12
Blackpool Corp.	„ 10	982	+ 102	..	48,181	+ 273	..	..
Blackpool-Fleetw'd	„ 12	573	+ 8	19	2,036	+ 648	..	..
†Bolton	„ 6	2,267	— 120	32	75,558	+ 85	26	..
Bournemouth	„ 9	2,897	+ 37	31½	61,865	+ 4,906	21·9	..
Bradford	„ 5	10,044	+ 601	32	162,955	+ 6,871	54·8	..
Brighton	„ 13	1,580	— 54	32½	34,244	+ 228	9·5	..
Bristol	„ 11	11,178	+ 708	..	..	..	..	..
Brit. Elec. Trac. Co.								
Airdrie	„ 4	443	+ 16	44	9,694	+ 68	3·65	..
Barnsley	„ 4	368	2	44	7,625	+ 113	..	..
Barrow	„ 4	463	+ 15	44	11,870	+ 1,551	5·37	..
Cavehill	„ 4	140	+ 26	44	4,093	+ 220	..	..
Devonport	„ 4	842	+ 103	44	18,937	+ 2,617	8·85	..
Gateshead	„ 4	2,026	+ 35	44	43,782	— 80	11·25	..
Gravesend	„ 4	393	— 15	44	9,220	— 186	6·5	..
Greenock	„ 4	1,021	— 25	44	27,656	+ 3,013	7·25	..
Hartlepool	„ 4	424	— 26	44	11,071	+ 616	6·72	..
Kidderminster	„ 4	191	+ 16	44	4,980	+ 163	..	..
‡Leamington	„ 4	307	— 30	44	7,603	— 303	..	..
Merthyr	„ 4	404	+ 31	44	9,184	— 152	2·9	..
Metropolitan	„ 4	15,705	+ 2,468	44	332,774	+ 57,297	22	..
Middleton	„ 4	595	+ 20	44	14,070	— 808	8·5	..
Mid. Joint Com'tee	„ 4	11,928	+ 456	44	256,694	+ 3,783	..	..
Oldham—Ashton	„ 4	1,111	+ 80	44	24,612	— 180	9·18	..
Peterborough	„ 4	204	— 11	44	5,207	— 80	5·31	..
Potteries	„ 4	3,948	+ 124	44	78,464	— 5 3	29	..
Rothesay	„ 4	88	+ 6	44	9,841	+ 159	2·75	..
Southport	„ 4	487	+ 30	44	13,174	+ 259	8·17	..
S. Metropolitan	„ 4	1,524	+ 24	44	35,8 3	+ 1,297	..	..
Swansea	„ 4	2,145	+ 160	44	48,078	+ 4,976	12·5	..
Tynemouth	„ 4	322	+ 1	44	11,637	+ 541	3·75	..
Weston-s-Mare	„ 4	98	— 10	44	6,988	— 3	3	..
‡Worcester	„ 4	524	+ 15	44	12,689	+ 229	5·75	..
Wrexham	„ 4	185	..	44	4,322	— 48	..	..
Yorks. Wool. Dist.	„ 4	1,992	+ 88	44	43,869	+ 3,206	17	..
Miscellaneous	„ 4	371	— 21	44	9,552	+ 273	..	..
Burnley	„ 12	2,421	— 35	..	..	..	11·6	1
Burton-on-Trent	„ 13	536	+ 46	32	8,993	+ 181	10	..
†Bury	„ 6	1,095	— 1	31½	37,730	— 205	22·5	..
Cardiff	„ 5	4,35[illegible]	+ 120	32	72,351	+ 863	..	..
Carlisle	..	..	..	..	..	..	..	..
Chatham and Dist.	„ 3	1,684	+ 67	44	38,046	+ 1,406	14·9	..
Cork	„ 10	926	+ 43	45	22,140	+ 1,707	9·8	..
Croydon	„ 4	3,212	+ 76	..	53,716	+ 3,513	11·25	..
Darlington	„ 12	404	+ 61	33	6,650	+ 528	..	..
†Darwen	„ 4	250	+ 10	31	7,841	— 83	4·36	..
†Dover	„ 5	186	+ 12	31	7,414	+ 263	4·75	..
Dublin	„ 11	10,390	+ 382	..	111,197	+ 1,998	54·2	..
Dundee	„ 9	2,299	+ 67	25½	31,267	+ 537	15	..
East Ham	„ 12	2,103	+ 242	32½	34,194	+ 1,444	8.52	..
Exeter	„ 11	573	+ 15	32	10,791	+ 629	5·5	..
Glasgow	„ 12	35,058	+ 1,078	..	424,594	+ 22,781	97·75	3·25
Hastings	„ 10	1,547	— 119	..	..	..	..	..
Huddersfield	„ 12	3,651	+ 225	33	57,647	+ 2,992	28·5	..
Hull	„ 12	5,429	+ 332	32	88,889	+ 4,542	14·5	..
Ilkeston	„ 9	237	— 2	32	4,229	— 217	..	..
Ipswich	„ 12	6·2	+ 28	32	14,448	+ 763	10·5	..
†Kilmarnock	„ 5	145	+ 10	25	3,9 7	+ 137	4·5	..
Lancashire United	„ 9	2,383	— 35	..	59,143	— 437	39	..
Leeds	„ 12	13,444	+ 239	32	230,2 0	+ 7,027	..	..
Leicester	..	..	..	..	..	..	..	..
Leith	„ 12	1,058	— 49	25½	16,374	+ 66	8·72	..
Liverpool	Oct. 29	22,041	+ 650	43½	480,199	+ 16,459	116	6·5
‡L.C.C.	Nov. 2	33,845	+ 6,950	..	1,302,473	+ 114,473	182·5	7
London United	„ 12	10,689	+ 3	..	287,525	+ 12,163	..	..
Lowestoft	..	..	..	..	..	..	..	..
Manchester	„ 12	30,358	+ 972	32	501,740	+ 10,839	183	1
Newcastle	„ 12	7,689	— 82	..	128,439	+ 873	14·5	..
Newport	„ 5	1,315	+ 99	32	21,605	+ 641	14·5	..
Oldham	„ 13	3,561	+ 159	33	61,792	— 546	23·75	..
Pontypridd	..	..	..	..	..	..	..	..
Portsmouth	„ 5	2,799	— 4	31	68,804	+ 1,416	15¼	..
Preston	„ 9	1,406	+ 31	32	23,682	— 47[illegible]	..	..
Rotherham	..	..	..	..	..	..	..	..
†Salford	„ 7	4,475	+ 92	31½	148,991	+ 2,831	..	..
Sheffield	„ 13	19,203	+ 850	32½	200,068	+ 11,728	40	·25
Southampton	„ 9	2,076	+ 33	32	86,090	+ 802	..	..
Southend-on-Sea	„ 9	848	+ 9·1	32	21,006	+ 2,418	..	..
South Shields	„ 12	1,024	— 30	32[illegible]	18,617	+ 44	..	..
Swindon	„ 9	276	+ 24	..	4,675	+ 205	..	..
Tyneside	„ 9	689	— 99	19	8,659	+ 143	..	..
Wallasey	„ 12	1.7[illegible]	+ 129	32½	31,581	+ 574	..	..
Walthamstow	„ 12	1,2[illegible]	+ 112	32	24,795	+ 1,558	9	..
West Ham	„ 3	4 957	+ 365	31	77,811	+ 3,8 7	15·25	·12
Wolverhampton	„ 9	1,805	+ 107	31	30,417	+ 3,327	14·25	1·75
Cen. London Rly.	„ 12	11,448	+ 33	19	102,746	+ 4,280	6·32	..
City & S. Lon. Rly.	„ 13	6.708	+ 215	19	59,399	+ 244	7·26	..
Dublin-Lucan Rly.	„ 11	236	+ 4	19	3,077	+ 146	7	..
G.N. and City Rly.	Oct. 29	2.918	+ 40	17	22,848	+ 709	3·5	..
L'pool Overh'd Rly.	„ 30	2,737	+ 4	..	26,014	+ 445	6·8	4·8
Llandudno-Col. Bay	„ 28	805	+ 19	48½	14,157	+ 412	..	..
London Elec. Ry. Co.	Nov. 12	28,245	+ 1,310	19	230,740	+ 2,250	21·25	..
Mersey Railway	„ 12	4,029	+ 19	19	37,454	+ 478	4·5	..
Metropolitan Rly.	„ 13	35,317	+ 1,330	..	319,390	+ 10,250	24·5	..
Met. District Rly.	„ 12	23,622	+ 1,981	19	198,927	+ 12,739	14	..
Anglo-Argentine	„ 11	96,454	+ 11,586	..	2,009,219	+ 237,061	..	..
§Auckland	Oct.	15.078	+ 1,582	..	60,342	+ 6,627	23·3	1
Bombay (B.E.T.)	Oct. 14	6,014	+ 768	41	111,165	+ 8,248	..	..
§Brisbane	Aug.	21,950	— 47	82	144,795	+ 13,548	..	..
§Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Nov. 12	7,020	+ 830	..	..	..	..	..
§ Cape Electric T. Ld.	..	..	..	..	..	..	..	..
§ Kalgoorlie, W.A.	Sept.	4,212	..	..	82,223	..	20·5	..
Madras	Oct. 31	1,362	— 84	..	27,130	+ 1,416	..	..
Montevideo	Oct.	23,012	+ 1,638	52	279,990	+ 26,783	..	..
§Lisbon	..	..	..	..	..	..	..	..
Perth (W.A.)	Oct. 28	2,731	— 54	..	53,639	— 6,314	29	1

* Compared with the corresponding period of 1909. † One week only.
‡ Includes horse, steam and other receipts. § One month.

STOCKS AND SHARES.

Tuesday Evening.

Markets are overhung by the political situation, and the chance of an imminent General Election acts as a blanket over everything. Not even the possibility of getting the trouble over before Christmas has lightened the visitation, and the House which is in Throgmorton Street looks with most unfriendly eyes at the other two Houses which are "Westminster way." It is generally expected that business will drop to a mere nothing until after the political ferment has subsided.

As regards the electricity supply market, Charing Cross Ordinary rose ¼, and the City Undertaking Preference shares are up ⅛, while City "Lights" fell a similar fraction, as did also London Electric Supply Ordinary. A general forecast of the next dividend statements was ventured upon in this column several weeks ago, and it is now necessary to add that more precise estimates would probably confirm the impressions then given, but with a leaning to the side of smaller profits rather than larger. In other words, the metallic-filament lamp will still appear as a handicap instead of an advantage to the companies, and proprietors must be content to possess their souls in patience for another six months or so, before the benefit of the increased supply, due to the new lamps, fairly makes itself felt.

Mexican Electric Light and Power Common remains at 91, although Mexico Trams are a point lower. Canadian General has fallen 2, making a drop of 5 in a fortnight, and the Preference is dullish at 120. Shawinigan quietly rises, and at 113 is 1 higher. Business was marked on Monday in Monterey Railway, Light and Power 5 per cent. First Debenture stock at 92¾, in Kaministiquia Power 5 per cent. gold bonds at 103¼, and in Northern Light, Power and Coal Fives at 83 and a shade under.

There is no holding back the prices of British Columbia Electric Railway Deferred and Preferred, further gains of 1½ and 2 points respectively being established this week on the top of the big rises last time. Canadian issues are in favour as a whole, and the effect of the last emission of the British Columbia Electric Railway has more than worn off. The 5 per cent. Preference stock is ½ up. Rio Trams at 105½ slipped back a little, but Sao Paulos at 156 show a point gain.

British Electric Tractions moved curiously, the Ordinary dropping ⅛ and the Preference picking it up. Metropolitan Electric Tramways Ordinary fell back to 15s. No change has taken place in London United Tramways this week.

Home Rails, as might well be supposed, are dispirited, and the market very limp. Most of the steam stocks gave way as a result of the Veto Conference failure, and consequent forcing of an election. Electrical railway stocks are dull rather than weak. Central Londons hold their prices, but City and South London lost ½ and Metropolitans are lower, the Surplus Lands parting with another 1 per cent. Districts, however, manage to keep steady. The price rose to 23½ before reacting ¼, but even so there is an improvement on the week. East London Ordinary, after being 4, retired to 3½, so electrification rumours have faded once more into the background.

The feature amongst the industrial securities is a jump of 7 in Electric Construction Debenture stock, the rise taking the price to 71½. The demand suggests that maybe the company is buying the stock for cancellation purposes. British Insulated & Helsby Cables Preference are ¼ lower: no doubt the market anticipates sales on the part of some of the proprietors who are attracted by the new, and well-secured, issue of Debenture stock. Babcock and Wilcox continue to ascend steadily, the price being up to 5¾, and Castner-Kellners hardened 7/16 on the excellent dividend statement and report.

Telegraph descriptions are not particularly volatile, for the time being, movements being mostly unimportant. People continue to buy West India and Panama Ordinary, and the price is ¼ better again. Both Preferences retain their previous advances. Indo-Europeans have been slightly pressed for sale, and Direct United States Cable shares fell ¼, while Anglo-American Telegraph Deferred shed ¾. Eastern Ordinary is 3 points higher, and Amazon Telegraphs put on as much as 17s. 6d., jumping to 5¾. The expectations run high as to a possible dividend, but it will be well for the buyers to recognise they may have to wait until next year for such a distribution.

Telephone varieties are firm. National Telephone Deferred gained ½, New York Telephone 4½ per cents. ¼, at 98¾. Trust issues keep good. Submarine Cables Trust certificates rose 1.

An article in last week's *Financial Times* on the subject of Electric Lighting Prospects drew a reply from Mr. H. B. Renwick, Chairman of the Electric Publicity Committee. Mr. Renwick pointed out how well organised is the publicity business of the electricity supply companies compared with that of the gas undertakings.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations Nov. 8th.	Closing Quotations Nov. 15th.	Business done week ended Nov. 15th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent.
		*										£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	4⅛— 5¼	5¼— 6	5¼	5¼	+ ⅛	Nil.
286,530	Do. 5 % Deb. Red. Iss. at 98 % script all paid	Stock	5 %	5 %	5 %	5 %	95 — 97	96 — 98	97½	96½	+1	5 2 0
955,196,000	American Telephone & Telegraph, Cap Stock	$100	8 %	8 %	8 %	8 %	145 —148	144 —147	..	..	—1	5 8 10
53,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	94½— 96½	94½— 96½	..	..	..	4 2 11
558,460	Anglo-American Telegraph	Stock	3⅞%	3½%	£3 4s.	3⅜%	66 — 68	66 — 68	66¾	..	..	5 6 7
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	106½—108½	106¼—108½	107½	107	..	5 10 7
3,220,770	Do. do. do. Deferred	Stock	1⅞%	1 %	8/-	25/-	27½ — 28	26¾— 27½	27¼	2 ¾	— ¾	4 11 9
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	9½— 10½	6¼— 7	9⅛	9¼	..	..
2,449,176	Commercial Cable, Sting. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	86⅜	86½	..	4 12 0
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8¼— 9¼	8¼— 9¼	..	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16¾— 17½	16¾— 17½	..	..	..	5 15 11
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅜— 3½	3⅜— 3½	..	..	..	5 1 7
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 %	8¼— 8⅝	8¼— 8⅝	..	..	..	5 14 3
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
60,710	Direct United States Cable	20	4½%	4½%	4½%	4 %	15⅝— 15⅞	15¼— 15⅝	15½	15 5/16	— ¼	5 2 8
36,000	Direct W. India Cable, 4½% Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	130 —133	133 —134	134¼	132½	+3	5 2 11
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	83 — 85	83 — 85	84	83½	..	4 2 4
1,896,706	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	4 %	4 %	101 —103	100 —102	100⅝	100	—1	3 18 5
300,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	7 %	12¾— 12¾	12¾— 12¾	12¼	12½	..	5 10 11
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
200,000‡	East. & S. Afric. Tel., 4 % Mt. Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99 —101 xd	99 —101	..	..	..	3 19 3
181,127	Globe Telegraph and Trust	10	5⅛%	5⅞%	5⅞%	5⅛%	10¼— 10⅜	10⅜— 10⅝	10⅝	10 11/16	..	5 9 5
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13¼— 13⅜	13¼— 13⅜	13⅜	13¼	..	4 7 3
150,000	Great Northern Telegraph, of Copenhagen	10	20 %	20 %	18 %	18 %	30⅜— 31½	30½— 31½	30¼	30½	— ⅛	4 9 4
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	13 %	52½— 54½	52½— 54½	52½	..	..	5 19 4
$41,380,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	94 — 97	94 — 97	..	..	..	4 7 8
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	75 — 80	75 — 80	..	..	..	5 0 0
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	Nil	3/16— 7/16	3/16— 7/16	17/-	15/9	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	⅞— 1	⅞— 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	15/16— 15/16	29/32— 29/32	..	..	— 1/32	5 8 4
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	105 —106	105 —106	106	105	..	5 13 2
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	123 —125	123½—125½	124½	123½	+ ½	4 15 7
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10⅛— 10⅜	10⅛— 10⅜	..	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10⅛— 10⅜	10⅛— 10⅜	..	..	..	5 10 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5½	5⅜— 5½	..	..	..	4 10 11
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	3½%	98½—100½	98½—100½	98½	98	..	3 9 8
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	99 —101	100½	..	..	3 19 3
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	7 %	8 %	8 %	8 %	1 9/16— 1 11/16	1 9/16— 1 11/16	31/3	..	..	4 14 10
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1 5/8— 1 11/16	1 5/8— 1 11/16	..	..	..	4 7 8
195,955	Do. do. do. 4 % Red. Deb. Stock	100	4 %	4 %	4 %	4 %	88 — 90	88 — 90	89½	89½	..	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	98½—100½	98½—100½	..	..	..	3 19 7
11,839	Reuter's	8	5 %	5 %	5 %	5 %	7⅞— 8⅛	7⅞— 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99 —101	98½—100½	..	..	— ½	4 9 7
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	6 %	130 —133	131 —134	..	..	+1	4 9 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	8 %	7¼— 7⅜	7¼— 7⅜	7⅜	7¼	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛— 5⅜	5⅛— 5⅜	5⅜	..	..	4 7 11
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	2½%	1 7/16— 1 15/16	1 7/16— 1 15/16	..	..	..	4 12 8
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	98½—100½	98½— 99½	..	..	..	3 19 7
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980	10	7 %	7 %	7 %	7 %	13¼— 14¼	13¼— 14	13⅛	13½	— ¼	5 0 0
800,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100—102	100—102	..	..	..	3 18 5
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	Nil	1⅜— 1 5/8	1⅝— 1 7/8	28/1½	25/-	+ ⅛	Nil
34,563	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	6 %	10 — 10½	10 — 10½	10⅜	10 5/16	..	5 14 3
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	14½%	9½— 10½	9½— 10½	..	..	..	6 0 0
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	5 %	102 —104	102 —104	..	..	..	4 16 2

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5% Cum. 1st Pref. 1 to 640,000	5	..	..	..	5 %	4⅛— 5	4 13/16— 5 1/16	99/4½	97/6	+ 1/16	4 18 9
500,000	Do. 5 % 2nd Pref., 800,000 to 1,800,000	5	..	..	..	5 %	4½— 4⅝	4½— 4⅝	92/9	90/7½	..	5 5 8
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	92 — 93½	92 — 93½	93	92½	..	4 5 7
332,387	Auckland E. Trams, 5 % 1st Mort Deb. Stock	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
890,000	Babcock & Wilcox, 1 to 890,000	1	20 %	20 %	20 %	24 %	5½— 5⅝	5⅝— 5 7/16	5 5/16	5⅜	+ 1/16	4 1 6
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000	1	6 %	6 %	6 %	6 %	1⅜— 1½	1⅜— 1½	..	..	..	4 0 0
1,000,000	British Aluminium 5 % Mort. Debs. Red.	100	..	..	..	..	..	..	..	..	..	5 9 7
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	143½—147½	146 —150	147½	145	+2½	5 6 8
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	120 —124	122 —126	123¾	122	+2	4 15 3
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109½—112½	110 —113	111½	111	+ ½	4 8 6
283,000	Do. 4½ % 1st Mort. Deb., 1 to 6,250	40	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
133,301	British Electric Traction	10	Nil	Nil	Nil	Nil	⅝— 1	⅞— 1	12/6	..	— ⅛	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	8 %	1½%	Nil	3½— 3⅝	3½— 3⅝	72/6	68/9	+ 1/8	Nil
1,473,653	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	5 %	88 — 92	88 — 92	89½	..	..	5 8 8
528,936	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	4½%	69 — 74	69 — 74	69½	69¼	..	6 0 0
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6⅞— 7⅛	6⅞— 7⅛	..	..	..	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6¼	5¾— 6	6 1/16	5 13/16	— ⅛	5 0 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
201,579‡	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	Nil	3/16— 5/16	3/16— 5/16	..	..	..	Nil
1,316,383	Do. do. 4 % Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	59 — 62	59 — 62	..	..	..	6 9 1
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	Nil	9/16— 11/16	9/16— 11/16	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	Nil	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	Nil	Nil	Nil	0 — ¼	0 — ¼	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	Nil	0 — ¼	0 — ¼	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	37 — 42	37 — 42	..	..	..	10 14 4
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	23 — 27	23 — 27	..	..	..	18 19 3
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	4½%	4½— 5	4½— 5	..	..	..	4 10 0
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	5 %	5 %	5 %	5 %	4½— 5⅛	4¼— 5⅛	..	..	..	4 17 7
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	98/9	..	..	4 9 1
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	10 %	9 — 9¼	9 — 9¼	9⅜	..	..	5 2 7
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	4 15/16— 5 1/16	4 15/16— 5 1/16	5 1/16	..	..	4 5 9
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	104 —106	104 —106	..	..	..	4 4 11
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	Nil	5/16— 7/16	5/16— 7/16	7/6	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	17½%	3 1/16— 3 3/16	3 1/16— 3 3/16	65/6	64/-	+ ⅛	5 6 1
210,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	105 —108	105 —108	106⅜	..	..	4 3 4
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	62 — 64	62 — 64	..	..	..	4 13 9
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 12 0
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	44 — 46	44 — 46	..	..	..	4 7 0
1,480,000	City and South London Railway	Stock	2½%	2½%	1½%	1½%	27 — 28	26¾— 27½	27	..	— ¼	6 7 8
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	5 %	Nil	Nil	½— ⅝	½— ⅝	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	83 — 86	83 — 86	..	..	..	5 17 8

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations Nov. 8th.	Closing Quotations Nov. 15th.	Business done week ended Nov. 15th, 1910. Highest	Lowest	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	5 %	⅞ — 1	27/32 — 31/32	12/-	16/9	—1/32	5 11 1
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	29/32 — 1 1/32	29/32 — 1 1/32	..	..	..	5 11 8
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	12½ — 13½	12½ — 13½	..	..	..	4 8 11
99,261	Edison & Swan Utd., "A" shs., £3 pd., 1 to 99,261	5	4½%	2½%	Nil	Nil	0 — 1/8	0 — 1/8	..	..	..	Nil
17,199	Do. "A" shares, 01—017,199	5	4½%	2½%	Nil	Nil	1 — 1½	1 — 1½	..	..	..	Nil
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	63 — 68	63 — 68	..	..	..	5 17 8
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	77 — 80	77 — 80	..	..	..	6 5 0
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	Nil	9/16 — 13/16	9/16 — 13/16	13/-	..	..	Nil
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	7 %	1 1/8 — 1 1/4	1 1/8 — 1 1/4	..	..	..	7 9 4
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	5 %	8¼ — 8½	8¼ — 8½	8¼	..	..	5 14 3
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	80 — 84	80 — 84	83½	..	..	4 15 3
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	3/4 %	Nil	Nil	¾ — 1	¾ — 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10¼ — 10½	10¼ — 10½	..	..	..	6 10 3
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —103⅜	102 —103⅜	..	..	..	4 16 10
40,000	Henley's (W.T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12¼ — 12⅝	12¼ — 12⅝	12½	..	..	5 17 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 1/16 — 5 3/16	5 1/16 — 5 3/16	..	..	..	5 4 8
150,000	Do. do. 4½ % Mort. Deb Stock	Stock	4½%	4½%	4½%	4½%	107½—109½	107½—109½	..	..	..	4 2 2
50,000	India-Rubber, Gutta-percha & Telegraph Works	10	10 %	10 %	10 %	10 %	14½ — 15½	15 — 15⅝	15⅝	15½	+ ¼	6 7 0
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	¾%	Nil	Nil	1 — 1⅛	1 — 1⅛	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	6⅞ — 7¼	6⅞ — 6⅞	..	..	+ 3/8	6 17 11
600,070	London United Trams. (1901) 1 to 50,077	10	3 %	3 %	Nil	..	1½ — 2⅛	1¼ — 2⅛	..	..	..	Nil
299,930	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1¼ — 2⅛	1½ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3⅜%	..	1¾ — 2	1½ — 2	32/6	..	..	15 0 0
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	67 — 71	67 — 71	..	..	..	5 12 8
5,732,062	Metropolitan Consolidated	100	1 %	⅜%	⅜%	1 %	37⅞ — 38⅛	37⅞ — 38	38⅛	37½	— ¼	2 12 8
2,640,914	Do. Surplus Lands	100	2¾%	2¾%	2¾%	2¾%	65 — 67	64 — 66	65½	64¾	—1	4 3 4
8,235,000	Do. District	100	Nil	Nil	Nil	Nil	23 — 23⅛	23⅛ — 23⅜	23 5/8	23 7/16	+ ¼	Nil
391,337	Metropolitan Electric Trams., Ord.	1	..	..	4½%	5%	3/16 — 1/4	11/64 — 13/64	15/7½	15/6	—1/16	6 3 1
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	1/9	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	29/32 — 29/32	29/32 — 29/32	17/-	..	..	5 9 7
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	97 —100	97 —100	99½	99	— 1	4 10 0
$10,823,200	Mexico Trams Co., Common Stock	..	..	..	..	6 %	125 —127	124 —126	126⅞	125½	..	4 15 3
$9,000,000	Do. 1st Mort. 50-year 5 % Gld. Bds.	..	..	..	5 %	5 %	97½ — 98½	97⅞ — 98⅞	98⅝	97⅝	..	5 1 6
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	3/16 — 5/16	3/16 — 5/16	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	7/16 — 11/16	7/16 — 11/16	..	..	..	7 5 5
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	82 — 85	80 — 83 xd	..	..	..	5 8 5
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	36 — 38	36 — 38	36½	..	..	5 10 3
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	101 — 103	101 —103	..	..	..	3 17 8
1,000,000	Underground Electric Railway, 5 % Prior Lien	..	..	..	5 %	..	100 —101 xd	100 —101	100⅜	100	..	4 19 0
2,800,000	Do. do. 4½ % Bonds	..	..	..	4½%	4½%	93 — 95	93 — 95	94¼	94	..	4 14 9
4,900,000	Do. do. 6 % Income Bonds	..	..	..	..	..	37 — 39	37 — 39	38¼	38	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1 — 1½	1 — 1½	..	..	..	10 0 0
245,495	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	60 — 70	60 — 70	..	..	..	5 14 4

ELECTRICITY SUPPLY COMPANIES.

30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	6¾ — 7⅜	6¾ — 7⅜	..	..	..	6 15 7
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	6¾ — 7⅜	6⅞ — 7⅜	..	..	..	4 14 11
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3½ — 4	3⅝ — 4½	82/6	..	+ ¼	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4¼ — 4⅝	4⅛ — 4⅝	85/-	83/9	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3⅝ — 4¼	3⅞ — 4¼	78/1½	77/6	+ ⅜	5 5 11
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 — 99	97 — 99	98½	..	..	4 2 6
49,436	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3⅜ — 3⅝	3⅜ — 3⅝	..	..	..	5 16 2
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11¼ — 11⅝	11 — 11¼	11¼	..	— ⅛	6 1 9
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11¼ — 12¼	11¼ — 12¼	11⅝	11¼	..	4 19 0
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	120 —124	120 —124	121	..	..	4 0 8
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99½—102½	99½—102½	..	..	..	4 7 10
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1½ — 2	1½ — 2	..	..	..	Nil
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	7 16 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94½ — 96½	94½ — 96½	..	..	..	5 3 8
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅜ — 7¾	7⅜ — 7¾	..	..	..	6 7 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11¼	10⅜ — 11¼	10 3/32	..	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	104½—107½	104½—107½	106½	105	..	4 3 9
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	Nil	1½ — 2	1½ — 2	..	..	..	Nil
430,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	4½%	75 — 78	75 — 78	..	..	..	5 15 5
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	5 %	5 %	81½ — 84½	81½ — 84½	..	..	..	5 18 4
10,000	Folkestone, 1 to 10,000	5	5%	5%	5%	5%	4½ — 4⅝	4½ — 4⅝	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	4 11 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	6⅝ — 7	6⅛ — 7	..	..	..	6 1 5
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	101½—103½	103 —105	103½	103	+1½	4 15 3
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	6⅞ — 7¼	6⅞ — 7¼	..	..	..	5 10 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
11,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1½ — 1⅞	1⅝ — 1⅞	30/-	..	— ⅛	5 2 2
70,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	..	4⅜ — 5⅛	4⅜ — 5⅛	..	..	..	5 17 1
382,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½ %	4½%	4 %	4 %	90 — 93	90 — 93	..	..	..	4 6 0
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	3⅛ — 3⅜	3⅛ — 3⅜	70/-	66/3	..	7 8 2
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	4 17 4
235,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	82 — 85	82 — 85	..	..	..	4 2 4
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	5 %	89½ — 90½	89 — 90	89⅞	89⅜	— ½	5 11 1
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	4 %	3½%	4 %	90½ — 91½	90½ — 91½	91½	90½	..	4 7 5
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	105½—106½	105½—106½	106½	105¼	..	6 11 5
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	93 — 94	9 — 94	93⅜	93	..	5 6 5
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 98	96 — 98	..	..	..	4 11 10
180,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	2½%	..	3⅜ — 4⅛	3⅜ — 4⅛	..	..	..	2 12 9
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	5 %	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	5 2 7
150,000	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,500	100	..	..	..	5 %	97½ — 99½	97½ — 99½	..	..	..	5 0 6
10,852	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	12 — 13	12 — 13	..	..	..	5 7 8
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6½ — 6⅞	6½ — 6⅞	..	..	..	5 3 8
119,694	River Plate Elcty. Co. Ord.	Stock	2½%	6 %	8 %	9 %	225 —235	225 —235	232½	..	..	3 3 5
100,000	Do. do. 6% Non Cum. Pref.	Stock	6 %	6 %	6 %	6 %	100—110	100 —110	..	..	..	5 9 1
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	100½—102½	100½—102½	..	..	..	4 17 7
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	7⅝ — 8⅛	7⅝ — 8⅛	..	..	..	6 2 2
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6¾ — 7⅜	6¾ — 7⅜	..	..	..	4 14 1
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	84 — 86	84 — 86	87	..	..	4 1 5
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1½ — 2	1½ — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2⅝ — 3	2⅝ — 3	..	..	..	6 13 4
130,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	2½%	3/16 — 3/8	3/16 — 3/8	..	..	..	Nil
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 5/32 — 1 3/16	1 5/32 — 1 3/16	20/-	..	..	6 16 7
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	96 — 99	96 — 99	..	..	..	4 10 11
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	¼ — 1	¼ — 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 — 2½	2 — 2½	41/3	..	..	10 0 0
275,000	Do. do. 4½ % 1st Mort. Deb. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	3/4 — 7/8	3/4 — 7/8	15/3	..	..	5 14 3
100,000	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	7⅝ — 8⅜	7⅝ — 8⅜	8¼	7⅝	..	5 19 5
51,279	Do. do. 4½ % Cum. Pref. (Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	..	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 5 per cent. October 20th. 1910.

PROCEEDINGS OF INSTITUTIONS.

Institution of Electrical Engineers.

INAUGURAL ADDRESS by S. Z. DE FERRANTI, President.

(*Delivered on Thursday, November 10th*, 1910.)

I PROPOSE this evening to address you on the following subjects: Coal Conservation, Home-Grown Food and The Better Utilisation of our Labour. I believe that these problems are closely connected, and are all capable in a great measure of being solved by means of an electrical treatment.

There are few subjects more important to the people of this country than the question of the rapid and ever-growing rate at which we are using up our coal supplies. Many writers have dealt with this subject, and have suggested various remedies. It may be said that the rate at which we use coal is a measure of our industrial activity and prosperity. This would be true, perhaps, if we were using our coal without waste, or at least with reasonable economy, but it is certainly not true of what we are at present doing.

Taking all the uses for coal into consideration, I believe that we are getting back an amount represented by useful work of one kind or another of much less than 10 per cent. of the energy in the coal. We can never, of course, hope to get anything like the full value of the energy in the coal, but, on the other hand, throwing away more than 90 per cent. of the value of our coal in the process of conversion is of the greatest possible concern to the country. Moreover, there is a further waste involved in our present methods of using coal which is only second in importance to the one I have spoken of.

We now dissipate nearly the whole of the valuable by-products contained in the coal, consisting principally of fixed nitrogen.

Besides the question of the waste of our coal by misuse, there is another cause working at an ever-increasing rate towards the exhaustion of our supplies. I refer to the immense exportation of our coal to other countries.

I will now turn to the question of our food supplies, and without going into details, which are available for everyone to read and study, I would remind you that we now import the greater portion of our food because we believe it pays us better to do so. This state of affairs is brought about by a number of complex circumstances, but is, in a measure, due to the necessary uncertainty of prices in our market under our present system, the comparatively small acreage that we have available, and to getting an insufficient return from the land that we have under cultivation.

Our only chance, however, of supplying our food requirements lies in a successful system of intensive cultivation throughout the country. This, in its turn, depends upon many things, but primarily it can be stated that it involves spending money in order to get the greater return required, and our farmers are naturally averse to spending money when the return to be obtained is so problematical. It is also attributable to the fact of intensive cultivation requiring a liberal supply of chemical fertiliser for the land, principally in the form of fixed nitrogen. This commodity, on account of the wasteful system of using our coal, is, I believe, at too high a price to make intensive cultivation attractive to the farmer. There is a further difficulty still standing in the way, viz., the want of knowledge on the subject of intensive cultivation, but I am sure that once a sufficiently general interest was felt in the country, and a sufficient prospect of reward to workers on this subject assured, that knowledge would grow at a rapid rate and soon bring about an efficient system of using our land to the best advantage.

The third subject that I have mentioned to you is that of our wasted labour. It may be said that all labour is useful insomuch as, if it were not required, it would not be used. On the other hand, we may consider the theoretical case of all labour being wasted insomuch as it is possible to conceive of a vast automatic machine which, with the direction of a single person, would fill all our possible requirements, and would include in its many functions a capacity for keeping itself in repair, and extending its operations to all new wants that it had to fill. There is, however, as in most things, the middle course for which we should aim, and that is, the supply of all our reasonable wants with the least possible amount of labour.

Looking at the question more in detail, we can first consider the labour spent in and about raising and distributing the coal which we now use, and which we would save under more economical conditions. Then there is the vast army of workers who are employed in cleaning up the dirt that is produced by our present methods of using coal. If you consider what goes on in every household you will see how large a proportion of the domestic labour is devoted to this. There are also all the people who are now employed in the process of burning coal for all the various uses to which it is put and who represent an enormous amount of labour which, under a more efficient system, could be turned to better account in the interests of the country.

It must be evident that the more efficient the running of the country as a whole the more rapidly must it add to its wealth and diminish the amount of labour which individuals have to expend in order to live at a given standard. This efficient working of the country to a large extent depends upon the proper use of its natural resources in the form of material and labour, and the saving of all waste in both of these which can possibly be brought about.

Considering the question of coal saving, by-product recovery, and labour saving, it is evident that the only way of obtaining material improvement under these heads is to concentrate the process of transformation of the coal and to carry out this process at the smallest reasonable number of centres.

It is in the process of transformation of coal into work in the form of heat and power that the great loss occurs, as this is always a most difficult process and requires the highest scientific and practical skill to carry out with even very moderate economy.

It has been proposed, with a view to accomplishing the above ends, to treat the coal at central stations and turn it into gas and distribute the energy in this form, but this process only goes a small way towards a solution of the problem, as under it, combustion—which is such a difficult problem—would be taking place at numerous points over the whole country, all tending to inefficiency, and the conversion of the gas into power is by no means easy, involving running machinery of the reciprocating class, requiring special and skilled attendance.

It appears that with a problem such as we are discussing it is fundamental that the energy in the coal should be converted at as few centres as possible into a form in which it is most generally applicable to all purposes without exception, and in which it is most easily applied to all our wants, and is at the same time, in a form in which it is most difficult to waste it or use it improperly.

We are, therefore, forced to the conclusion that the only complete and final solution of the question is to be obtained by the conversion of the whole of the coal which we use for heat and power into electricity, and the recovery of its by-products at a comparatively small number of great electricity producing stations. All our wants in the way of light, power, heat, and chemical action would then be met by a supply of electricity distributed all over the country.

It must, however, be remembered that the distribution of energy in the form of electricity instead of coal can only be effectively carried out when it can be done in such a way that it is available for all the purposes for which coal is now used, and this can only be the case when the conversion is effected at such an efficiency as will cause the electric energy delivered to represent a high percentage of the energy in the coal. Failing this no scheme for conversion at the pit's mouth, and delivery of energy in the form of electricity, is sound. There is also another controlling factor which must be satisfied in order to make this scheme possible. Both the conversion of the coal into electricity and the distribution of the current must be effected at a low capital cost so as not to overburden the undertaking with capital charges.

Considering the various processes of conversion which are now available, or which may be invented, and their possible and probable efficiency, we first come to electric generators driven by reciprocating steam engines. Their efficiency, expressed in the form of energy in the coal to electric energy, may be taken as a maximum of 10 to 12 per cent. This is, of course, far too low an efficiency to make any scheme such as I have already indicated possible, besides which the capital expenditure and the complication involved are far too great, and the size of the units too small, to be thought of for the purpose in view.

We next come to large steam turbines such as have been constructed up to the present, and see that their maximum efficiency may be put down at about 17 to 18 per cent.

Next in the list, in order of economy, comes the big gas engine fed from gas producers, with an efficiency of coal energy to electric energy of possibly 25 per cent.

In the future we have to look towards two other means of conversion—the gas turbine-driven electric generator and the production of electricity in some more direct way from the coal, but these two means of conversion, although being capable of giving the most efficient results, are so much in the distance, that they are quite beyond our present consideration.

After very careful thought on the subject I have come to the conclusion that, in order to supply electricity for all purposes it would be necessary, amongst other things, to have a conversion efficiency of not less than 25 per cent.

For the purpose of looking into this question I have taken the figures of production and consumption given in the Report of the Royal Commission on Coal, which clearly summarises the position as it stood a few years ago, and as the increase taking place is fairly regular these figures have been taken throughout. According to this report 167 million tons of coal were being used in the country in 1903. Of this amount 2,000,000 tons went to coasting steamers and 15 million tons were used by the gas companies. In order to simplify matters, and make the figures clear, I have left out of consideration the coal used on these two items, and taken the balance—viz., 150 million tons—as the annual coal consumption of the country. If now, instead of using this coal for doing work as at present, we were to convert it into electricity, we should use, instead of 150 million tons, 60 millions tons of coal a year. This coal, turned into electricity, would produce 131,400 million Board of Trade units, and the electricity so produced would, after allowing for losses of transmission and the conversion into work of different kinds, be sufficient to supply the whole of our requirements now being satisfied by the use of the 150 million tons of coal which we now burn. To form an idea of the magnitude of the proposal, it is well to compare it with electrical supply as we know it to-day. At present, of all the coal we burn in the country, only one per cent. is used by the public electric supply works of which returns are published, and it is therefore evident that electricity has up till now hardly commenced to displace direct-used coal.

In the conversion of coal into electricity one of the most important considerations is the load factor at which the converting and distributing plant effects the operation.

Electricity used for lighting, cooking, power, and traction, must be supplied as and when required. On the other hand, domestic heating will be done largely through the medium of heat storage, and is therefore a controllable form of demand. Metallurgical and chemical processes, which depend for their success upon a very cheap supply of current, will have to be so adapted and modified that they can take current intermittently and so fill up the load curve, thus enabling the current which they require to be pro-

duced with the least capital expenditure, and, at the same time, greatly assisting the good conversion efficiency of the whole supply. I believe that under the circumstances a load factor of 60 per cent. would be obtained. At first sight it seems unreasonable to expect such a load factor, but it must be remembered that our ideas are based on the present electric supply which only uses some 1 per cent. of the coal now consumed in the country.

At present, as is quite natural, electricity is used for what coal does least satisfactorily direct, and it is misleading to compare the load factor so obtained with those which will be got when electricity replaces coal entirely.

Considering now the means to be adopted for converting the coal into electricity, and the efficiency at which this can be done, we find that in gas-engine-driven alternators we have a system theoretically capable of returning 25 per cent. of the energy in the coal in the form of electricity, and from this point of view they would meet our requirements. The gas engine, however, as a converter of energy on the scale required, suffers from the fact that the units are too small and the cost of the complete installation is too high. These difficulties appear to defer the realisation of an all-electric scheme until electricity is generated by some gas turbine of the future, or direct from coal by chemical action.

There is, however, an intermediate process of conversion which will, I believe, give the necessary efficiency without undue complication or expense. The steam-gas turbine in which steam is used in the state of a gas at a high temperature throughout the process of conversion into work, gives theoretically a high efficiency at workable temperatures, and I believe will, in the course of time, supply the necessary means of conversion for effectively turning our coal into electricity. I have considered the case on these lines.

In order to produce the supply of 131,400 million Board of Trade units at a 60 per cent. load factor, machinery of the normal capacity of 25 million KW. would have to be installed.

For the purpose of estimation it may be considered that this capacity would be divided up into 100 stations of the capacity of a quarter of a million KW. Each of these stations would contain 10 generators of 25,000-KW. capacity. These stations would be spread about the country to supply the demand in each part roughly proportional to the coal now consumed.

The positions of the actual generating stations would be largely controlled by the facilities for obtaining coal and water for condensing. In many cases they would be close to the colliery districts, and the current would be transmitted to the points of demand. In other cases, where a considerable demand was concentrated at a distance from the sources of coal supply, and where the coal could be cheaply carried—especially by water—stations would be installed and would supply electricity to meet the surrounding demand. In all cases, however, whether far from, or near to the coal production, the coal would be delivered in very large quantities to only a few points of consumption, and would thus reduce the labour and cost of transmission and handling to the lowest figure.

Many works taking a large quantity of electricity for metallurgical and chemical purposes at a very low price would be built adjoining the generating stations, and other existing works would be at such short distances that the capital costs for distribution of the electricity which they used would be very small.

Estimating on the basis of the typical generating station considered and multiplying by the number of stations, I have put down the capital cost of generating works at £7 per KW., which, for the total kilowatt required, gives an expenditure of 175 millions sterling. The cost involved in the distribution system on such a scale is difficult to estimate. The conditions of demand in relation to the position of the supply stations would, however, be favourable, as a great deal of the energy required would be transmitted only short distances, and units of demand would be large. Under the circumstances, I believe that £13 per KW. would be amply sufficient, and a sum of 325 millions sterling would thus cover the cost of the distribution system.

The total cost of the scheme, including all expenses up to the point of delivering the electric supply to the consumer, would thus be 500 millions sterling. This, of course, is a very large figure, but, considered in relation to other industries and the results to be accomplished, it cannot be considered excessive.

It has been estimated that the capital now invested in this country in electrical undertakings amounts to some 400 millions sterling. Last year the electric supply business had invested in it some 58 millions sterling. The proposed scheme would therefore absorb from eight to nine times the amount of capital now invested in the portion of electric supply undertakings for which figures are available. The units generated upon the all-electric method of working would, however, be some 150 times as great as those generated by the above undertakings, and the cost of production and the sale price of current would, of course, be very much lower than at present.

The cost of producing the electricity required under the scheme may now be considered. Capital costs taken at 8½ per cent. upon the money invested, form by far the most serious item, and amount to 0·0776d. per unit, or a total of £42,500,000 per annum. The works costs would, I believe, not exceed 0·036d., bringing up the total costs, including interest and all other charges, to 0·1145d. per unit, or 62 millions sterling per annum.

In arriving at the above figures for the cost of generation 60 million tons has been taken as the annual coal consumption, and this has been charged at an average price of 10s. per ton, thus amounting to 30 millions sterling. On the other hand, it has been assumed that with improved processes of conversion, 1 ton of coal will yield fixed nitrogen equivalent to 1 cwt. of sulphate of ammonia. The present price of this commodity is well over £12 a ton, but considering the large scale of production and the necessity of supplying it at a low price to make its use general for agricultural purposes, I have reckoned the fixed nitrogen as of a value of only £8 per ton of sulphate of ammonia, or, on the 3 million tons to be produced, of 24 million pounds sterling. This reduces the cost of coal to 6 millions sterling, which largely accounts for the low works costs.

The cost of chemicals required to make the fixed nitrogen available, together with the necessary labour involved in the process, would be met by the sale of the other coal by-products—principally consisting of tar and oils.

It is, of course, well known that firing by means of gas compares unfavourably with using the coal direct. It is also generally found that a good return of fixed nitrogen in the form of ammonia is only obtained from the coal at a sacrifice of thermal efficiency, and also involves a much smaller yield of the other by-products which can be extracted from the coal, but now that the importance of these matters is realised a great deal of work is being done to improve the processes, and eventually it will undoubtedly be possible to obtain the high return that I have spoken of without sacrifice in other directions.

Following upon the costs of electric generation already discussed, I have assumed, for the purpose of comparison, that the average price at which current would be supplied throughout the country would be ½d. per Board of Trade unit. The charges would not be uniform, but would be graded according to the position and nature of the load supplied.

It is interesting for a moment to consider the effect of such a supply of electricity upon its present and future uses.

Taking lighting to begin with, which was the first application for which a supply of electricity was generally given, it will be clear, considering the strong position which electric lighting now holds even with current at an average price of 2d. per Board of Trade unit, that when it is obtained from current at the much lower prices that would rule under the all-electric scheme, no other form of light would have a chance in competing with it.

Notwithstanding present high prices, a good deal of electric cooking and heating is already being used, and although it would appear to be too expensive for general application, still, the very good results obtained, and the large amount of labour saved, are already sufficient to justify its use to-day.

When electric heating and cooking are carried on with current at the very low figures at which it would be possible to sell for these purposes, it would only be a matter of time for all heating and cooking to be done by means of electricity.

Regarding the supply of power, electricity is now admittedly the most convenient form of power for all purposes, and this, again notwithstanding the costs involved on the comparatively small scale on which we now produce. The overwhelming advantages of electric power at a price at which it would be supplied on the all-electric scheme would clearly ensure its use for all power purposes.

The case with regard to electric tramways and light railways is well known, and any reduction in the cost of running due to cheaper current would, of course, act greatly in favour of these undertakings, and would help to extend their usefulness. Light railways, which, for various causes, have made such poor progress, if sensibly dealt with, would greatly benefit by finding a cheap supply of energy available in all parts of the country.

The electrification of main-line railways has not yet progressed very far, as it is hard to make out a sufficiently strong case to warrant the large expenditure necessary for electrification; but there is little doubt that growing traffic, which necessitates additional works, will be best met by electrification, which will enable a greater return to be obtained from existing lines and works. The electrification of our railways would be greatly assisted and made a more profitable investment if a supply of current at such a figure as we are now considering were available for their working.

The manufacture of pig-iron is, no doubt, quite the most economical use of coal that we now have, but recent work with electric smelting furnaces has shown that it is only necessary to have electric current at a low enough price, and for sufficient experience to be obtained, to make it more economical to smelt iron electrically than by present methods, and using only sufficient coke to provide the carbon for the purpose of reduction.

It may be taken, from the experiments already made, that when worked on a sufficient scale ¼ ton of coke would be required per ton of iron produced, and that 4 tons of iron would be obtained per kilowatt-year. This would mean that about 0·42 ton of coal would have to be converted into coke and used per ton of iron, together with about 2,200 Board of Trade units, which, at ⅛d., would come to 15s. 3d. per ton of iron. As the electric furnaces would no doubt closely adjoin the generating station, the price named for current would be a very good one. We should thus have a cost for coke and electricity of about 19s. 6d. per ton of iron produced.

According to the recent Report of the Royal Commission on Coal, pig-iron, on the average, now requires about 2 tons of coal per ton of iron produced, and taking this at the same price as coal has been taken for the purpose of electric generation, viz., 10s., this would give 20s. as the cost of fuel per ton of iron produced. It is, however, probable that the production of pig-iron electrically with current supplied to the works would involve less plant and a less upkeep of plant than at present: also a good deal less labour would be required. Improvements in the process brought about as the result of experience would, no doubt, further reduce the costs, and would result, in all probability, in a better article at a lower price.

We at present produce about 10 million tons of pig-iron. This would therefore require 2½ million kilowatts of plant run continuously and producing 22,000 million Board of Trade units annually. In order to get current for this purpose at the lowest price, it would in all probability be found desirable well to insulate the furnaces to avoid heat loss, and for the same reason to have

individual furnaces of a very large capacity. It would then be possible to work intermittently and yet with economy and so use the current taken by the furnaces to fill up the load curve, thus adding to the economy of conversion and reducing the capital expenditure involved in electric plant.

Steel-making electrically is already in extensive use, and even with present facilities for generating the current which the process requires, is beginning to make considerable headway. All steel would, of course, be produced electrically as soon as sufficient experience had been gained regarding details and a supply of very cheap current was available. Foundry work in both iron and steel would be most conveniently carried out by means of electric melting. It is already known that the electric furnace gives the best results obtainable for steel castings. The heating of steel for rolling, forging, and annealing will be most efficiently carried out electrically as soon as the cheap supply warrants experimenting in this direction. In fact, all furnace work for which coal or gas are now used could, I am convinced, be more satisfactorily done electrically when an abundant and cheap supply is available.

We now use aluminium for a number of purposes, notwithstanding our want of knowledge as to the best ways of working it. When our experience with aluminium in any way approaches what we now know about the working of steel, it is certain that vast quantities of this material will be used throughout the world. The manufacture of aluminium is another of the processes which will be greatly facilitated by a cheap supply of electricity. In fact, it may be said that aluminium can only be produced economically at present in water-power countries; but as an intermittent supply of electricity could be given under the proposed scheme at a lower price than it is being obtained at from water powers, we should be in a better position than the water-power countries to manufacture this metal. With cheap electricity available, electro-chemical processes must grow and multiply to an enormous extent, and not only should we produce for ourselves all the chemicals which are now produced electrically abroad, but everything that can be produced electro-chemically would then be made in this country.

There is a further application of the electric current which, so soon as the price was low enough, would, no doubt, largely come into use. This is in the intensive growing of fruit and vegetables under glass. It is known that considerably more forcing in the way of heat can be advantageously applied where light is also furnished artificially, and it is therefore probable that, with electricity everywhere available at a low price, an immense amount of intensive cultivation under glass with the heat supplied by means of the electric arc would be undertaken, as in supplying heat by this means light would also be supplied, which would have the effect of enabling the growth to benefit fully by the artificial heat.

Summarising the whole position, it may safely be said that, whatever coal, gas, or power are now used, everything for which they are used will be better done when electricity is the medium of application.

Hardly less in importance in the all-electric scheme is the question of the by-products which become available by the proper use of our coal. These consist principally of fixed nitrogen, together with tar and oils.

Fixed nitrogen in the forms of sulphate of ammonia, nitrate of soda, and nitrate of lime are most valuable fertilisers, and enable land continually to produce the same crops with a greatly increased yield per acre. Much has been done in finding out how best to utilise these artificial fertilisers, but no doubt a great deal more will be done in this direction, and fertilisers will be prepared, with fixed nitrogen as their principal constituent, which best suit the particular soils and crops that it is desired to deal with.

According to last year's Board of Trade returns we now grow about 23 per cent. of the total wheat that we use and import 77 per cent. Of the barley used we grow 59 per cent. and import 41 per cent., and of the oats used 78 per cent. is home grown and 22 per cent. imported. Last year we devoted 7¾ million acres to the cultivation of these crops.

Much is being done to improve the yield of corn crops, and it is probable that with scientific treatment in the production of the seed, in the sterilisation of the ground, and in the application of fertiliser, we may look at no distant date to an increased yield of 50 per cent. in these crops upon what is now being produced per acre. The most vital feature, however, in bringing this about, once we have acquired sufficient knowledge, is an ample supply of fixed nitrogen to use as fertiliser, and it is when considered from this point of view that a scheme which supplies this from our coal as the result of saving present waste is most important.

With the increased yields which we have mentioned we could produce corn crops sufficient to supply the whole of our requirements upon 11 million acres. This would represent 23½ per cent. of our present cultivated area, and would only be an addition of 3½ million acres to the land now used for the purpose of growing these same crops. The value of these additional crops would be about 58 millions sterling, based upon the prices which we paid last year, and to this would have to be added the value of the straw and the other wheat by-products, which would go a long way towards providing the food for growing the additional meat which we require to supply our demand at home.

In order to fertilise the land, we should have available under the all-electric scheme 3 million tons, or its nitrogen equivalent, of sulphate of ammonia. This, if used over the whole of the 46¾ million acres now under cultivation, would give 143 lb. per acre; but, of course, the fertiliser would be distributed according to the nature of the land and the crops being grown. It is probable that under these circumstances the increased yield of the land now cultivated would not only give us all the grain that we should require for food, but also all the foodstuffs, partly as by-product from the grain and partly grown, that would be required for raising the cattle, sheep, and other animals necessary to supply the whole of our wants.

It is now beginning to be understood that intensive farming of the land also involves intensive cattle raising, and that it is very advantageous greatly to reduce the amount of grass land and instead to grow crops intensively cultivated, as in this way a given amount of land can be made to produce a much larger yield.

Sulphate of ammonia is a particularly good fertiliser for the purpose of growing sugar beet, and here again it is probable that the availability of large quantities of this fertiliser at a very much lower price than at present prevails would enable us to produce the whole of our sugar at home, especially as the by-product obtained in the form of crushings from the beet is a very valuable food for cattle raising, and also as the crop is a very suitable one for growing alternately with wheat.

If it were found that a larger amount of fertiliser than the 3 million tons of sulphate of ammonia, which would be the principal by-product from the 60 million tons of coal turned into electricity, could be advantageously used, this would be very economically produced from the electrical station by the oxidisation of atmospheric nitrogen, giving a valuable fertiliser in the form of nitrate of lime. This could be made intermittently by means of current filling up the load curve, and would not necessitate the expenditure of any more money on plant for generation or transmission of the current. It would, however, require the burning of additional coal, and this in itself would add to the sulphate of ammonia available.

The output of the 25 million kilowatts of plant installed has been reckoned upon a 60 per cent. load factor, but it is quite possible that the load curve could be still further filled up by an additional 20 per cent. for any purposes such as those just stated. In this way it would be possible to burn an additional 20 million tons of coal annually, producing a million tons of sulphate of ammonia and other by-products, and 43,800 million additional units, which could be sold at a considerable profit at $\frac{1}{10}$d. per unit, as the cost would not exceed $\frac{1}{20}$d. per unit.

A certain proportion of this extra supply of current could be used to fix nitrogen in addition to that obtained direct from the coal, should this latter supply be insufficient for the country's wants, and the balance of the current used for electro-chemical or other requirements which could take power intermittently.

In this connection it must be remembered that an intermittent or controlled make-up load may be intermittent to the extent of 80 or 90 per cent. of the load, a certain amount of current being always kept on to make up for heat losses in furnaces or to prevent reversal in electro-chemical work.

If the whole of the additional output could be taken up, the effect of the increase of revenue, together with the difference on the original figures of selling the first 60 per cent. at an average of ¼d. instead of at the lower figure of 0·1145 of a penny already mentioned, would enable 10¾ per cent. to be allowed on the capital instead of 8½ per cent. already provided for.

It is assumed by many people that the climate of this country is largely unsuitable for the purpose of growing food, and for this reason it is thought we can never grow the food which we require. This is largely a misconception, as crops both large in quantity and of good quality can be produced in this country. Nevertheless, it would be a desirable thing if, instead of the dark weather that we now often experience owing to cloud obstruction, we could have continuous sunshine at certain times of the year. The amount of sunshine would, no doubt, be largely increased by the abolition of all smoke in the air, as not only does the smoke itself obscure the sun, but also it seems to have the effect of assisting the formation of cloud, which greatly diminishes the light and heat which we receive.

At present it is considered quite right and reasonable to canalise rivers and make great works for adding to the fertility of countries by means of irrigation, but I believe that in the future the time will come when it will be thought no more wonderful largely to control our weather than it is now thought wonderful to control the water after it has fallen on the land. I think that it will be possible to acquire knowledge which will enable us largely to control by electrical means the sunshine which reaches us, and, in a climate which usually has ample moisture in the atmosphere, to produce rainfall when and where we require it.

In seems to me that it may be possible, when we know a great deal more about electricity than we do to-day, to set up an electrical defence along our coasts by which we could cause the moisture in the clouds to fall in the form of rain, and so prevent these clouds drifting over the country between ourselves and the sun which they now blot out. It also seems to me that it will be possible, when more water on the country is required, to cause the falling of rain from the clouds passing over the highest part of the country and so produce an abundance of water which, properly used, would greatly add to the fertility of the country.

Of course, it may seem that these are only mad visions of the future, but I think we can hardly consider these results more improbable than anyone would have considered wireless telegraphy or flight in heavier than air machines 50 years ago. My excuse for mentioning these matters here is that they might constitute another great use of electricity, and their useful consummation would certainly be facilitated by an abundant supply of electrical energy.

There would be further by-products from the coal in the form of tar and light oils. The effect of their abundant production and sale at a low price would be most important to the country, as the large quantity of tar produced would enable us to make good roads, which we much need, and which would have the lowest cost of upkeep, and the light oils would, when carburetters have been further

developed, go a long way towards supplying the fuel for our motor-cars and other motor-vehicles which we now have to import from abroad.

As there must be an enormous development in the way of motor traction, these two by-products become most important. The necessity for labour-saving appliances used in agriculture must greatly add to the number of motors which cannot, according to present knowledge, be replaced by electricity, and these, no doubt, would be made to burn the heavier oils which would be produced as part of the coal by-products.

Considering the general effect of the all-electric scheme, in which, with but small exception, the whole of the coal used is turned into electricity, the first important effect would be the saving of some 80 to 90 million tons of coal a year. As we should produce the whole of our food requirements, we should not have to export our capital in the form of coal to help pay our food bill. In this way, by making these two savings, we could prolong the useful life of our coal measures 2½ times, and still have 20 million tons of coal a year available for the use of our steamships over and above the coal required in the country.

The saving of labour now employed in raising the vast amount of coal which we now waste or send abroad, and also the labour employed in transporting this coal and using it for all the various purposes for which it is now required, together with the labour employed in cleaning up and getting rid of the effects of burning coal according to our present methods, would all be available for additional manufacturing of the articles now imported and for use on the land.

The saving of so much wasted labour and material would greatly add to the prosperity of the country and so enable us to support a larger population living under more healthy and comfortable conditions than at present.

Cheap electricity would greatly stimulate all manufacturing operations, which would, in turn, enable labour to be much better remunerated than at present, and to enjoy a much higher standard of comfort. The higher value of labour would in its turn stimulate inventiveness and the production of all sorts of labour-saving appliances which, with cheap electricity, would enable us to produce in the future under suitable market conditions at cheaper rates than are now possible, notwithstanding the better return that labour would obtain.

Great hardships are always produced where any great industrial change is made, but the more efficiently we can carry on the work of the country, the more margin must there be for the great majority of the people: so that any change which decreases the amount of labour required must eventually give the people greater comfort and less arduous work. It is hardly necessary to point out how much better the position of the country would be if we were producing the whole, or nearly the whole, of our requirements, as, in this case, we should be far less liable to be adversely affected by any external causes or by the occurrence of any great war.

At present, although the using of our coal may mean commercial activity, it certainly means the desolation of the country in parts where it is largely used. Instead of this harm being done to the country by our coal, we should fertilise the lands by its means and might even, as I have indicated, use it in the future to increase our sunshine.

Of course, there are many things which at present stand in the way of realising such a scheme as I have outlined. There are many technical details, which nothing but an immense amount of work can solve satisfactorily. There are also political and legislative difficulties standing in the way, but these, when the time arrived, would have to be got rid of rather than allow them to handicap the advance of the country. The more, however, that I have considered these ideas in detail, the more certain am I of the fundamental soundness underlying them, and that it is only a matter of time before such a scheme is carried out in its entirety.

What interests us most, perhaps, is the question of how long it is likely to be before the all-electric idea becomes possible. At present there is so much required to be done to make it workable in all its details, that it seems as though its realisation would be long deferred. It must, however, be remembered that knowledge is continually being acquired which brings us nearer to its realisation, and that things engineering, and especially in electrical engineering, now move very rapidly. It may therefore come to pass that the all-electric idea, with its far-reaching changes and great benefits, will become an accomplished fact in the near future.

Telephone Service in America.

During the International Conference of European Telephone and Telegraph Administrations, at Paris, an address was delivered by J. J. Carty, chief engineer of the American Telephone and Telegraph Co., analysing the features of manual and automatic operation of telephone circuits and connections.

The following abstract of the address is derived from the *Electrical Review and Western Electrician*:—

I will tell of conditions in America, with which I am personally familiar, and regarding which I have accumulated data covering a period of years.

Let us begin with the so-called manual switchboard and make a brief analysis of its methods of operation; we shall find that it abounds in automatic features and that in its operation automatic labour-saving machinery has been employed to an extent which is truly surprising. The term manual does not correctly describe the system to which it is applied; the so-called manual switchboard system is partly manual and partly automatic, and the number of automatic operations which takes place in making a connection forms a large proportion of the total.

The subscriber desiring to make a call first takes the telephone from its hook and places it to his ear. This is a manual act which is necessary in every system. Removing the telephone automatically releases the hook, which flies into contact with several springs, the result of which is to set in motion a train of automatic apparatus closing the subscriber's circuit at the sub-station, thereby automatically actuating a relay at the central office. This relay lights a lamp before the operator, who thereupon performs a manual act, inserting the plug into the answering spring jack. This again automatically makes connections which accomplish a number of different operations, such as disconnecting the line relay, and so forth. The operator works her listening key and connects to the called-for subscriber. This causes a train of automatic operations to take place, and then the subscriber's bell in rung. He takes the telephone from the hook, and this automatically notifies the operator that he is at the telephone.

The reverse of all this takes place when the disconnection is made. The subscribers hanging the telephones on their respective hooks, set in motion a complex train of automatic operations, whereby the operator, without listening in upon the line or asking the subscribers if they have done talking, may determine at a glance that the conversation is finished, and by the simple operation of withdrawing the plugs and allowing them to fall automatically into their positions, mechanism is released which automatically restores the lines to their original condition.

In the handling of trunk calls—*i.e.*, calls between the "A" operator and "B" operator in the different offices, another extended series of automatic operations is intermingled with those which are performed manually. Thus it will be seen that, notwithstanding what may be said by the partisans of the so-called manual system, they have by their deeds acknowledged that there are many advantages in automatic machinery; in fact, if we trace the evolution of the manual switchboard as exemplified in the modern common-battery system, we shall find that its progress towards the present high state of efficiency is marked by the adoption of machinery to perform operations which, in the earlier systems, were done by hand.

In the old type of manual systems it was necessary for the subscriber, in order to signal the office, to turn a crank, thus operating the magneto-generator and throwing a drop at the central office. At first it was necessary for the operator to restore this drop by hand. Then a plan of automatically restoring the drop upon the insertion of the plug by the operator was adopted. Finally, the drop itself was removed and relays, automatically controlled by the subscriber and bringing into play at the proper time electric lights, were substituted.

A study of the growth from the earliest systems to that at present in use shows in a very interesting way that the high efficiency now obtained from the common-battery system is largely due to the adoption of automatic operations.

Turning now to the so-called automatic system, and making but a brief analysis of its operation, we find that, properly speaking, it is not an automatic system, but only partly so, and that without the aid of human intelligence at the central office, and without the employment of operators, it has not been possible to operate it on any substantial practical scale. While this is true even in a telephonic network with a single central office, the full force of the statement is not appreciated until we contemplate the so-called automatic system as applied to a comprehensive telephone system, such as sooner or later must grow up in every country and in every city.

Let us consider the operations of the automatic system in the elementary case of a single central office. The subscriber desiring to send a call must take his telephone from the hook and perform a number manual operations, depending upon the character of the call he wishes to send. Then he must press a button, which, if all goes well, rings the subscriber desired.

It has been found in practice, however, that this automatic machinery at the central office can be made to give service only by the aid of mechanicians constantly in attendance there. The duty of these mechanicians is not simply to make repairs and remove faults in the ordinary sense of the term, for they do more than this. They actually assist the machinery to work. By the most careful training, some of them become exceedingly expert, so that with a supersensitive ear, they are able to detect when the machinery is going wrong. They are equipped with portable telephones and transmitters, and when they have reason to suspect that the call is not going right, they listen in upon the subscriber's line, and if the machinery has gone wrong, they ascertain from him the number desired and operate the machinery by hand, so as to produce the desired connection.

The assistance which they give requires them to listen frequently to the conversation of the subscribers and to give constant surveillance to the connections. This supervision is as varied as the character of the faults encountered.

These men, whose presence is essential to the working of the system, are, in fact, "mechanician operators." In addition to these, operators must be employed for toll and long-distance work, for answering subscribers who call for numbers which have been changed, and for performing those large classes of service requiring human intelligence.

In America, wherever you go into an automatic exchange, so-called, there you will find operators employed for these various classes of service which I have mentioned, and for more which I might give in detail if time permitted. In all of these exchanges comfortable operators' quarters are to be found, together with the usual provisions of lavatories, retiring rooms and other conveniences which are to be found in the so-called manual exchanges.

But it is not in the system in its undeveloped state, employing only one central office, that the manual features of the automatic system are to be most clearly discerned. In order to see how thoroughly misleading is the term automatic switchboard as applied to these systems, it is necessary to contemplate a telephone system more or less highly developed.

To do this we must consider the telephone system as a whole, taking into account all of the circumstances of the case, not simply one, or two, or three of them, but the whole multitude of factors which enter into such a complex problem.

We must give rigorous attention to a vast amount of data and requirements pertaining to the traffic upon which the design of the system is based, and we must take carefully into account all of those important commercial circumstances which have such a profound, though often unsuspected, effect in broadly shaping the results.

It is only after we have done all of these things that we are prepared to begin to design the plant of the telephone company or administration. In a problem such as ours, in order to attain successful results, we must contemplate a plant or system as it must exist at its different stages of development. Each day, each month, each year, our plant is growing, and we must so shape it, and so add to it, that as this growth proceeds it will have the highest efficiency which may be expected of it at each period of time, and that when the system is fully developed, it will be working at its highest efficiency.

While the central office switchboard is a vital part of the system, it is by no means all, and considering the telephone investment as a whole, the money invested in central office switchboards is a relatively small part of the total.

In our American practice we have for years endeavoured, with success, to take this view of the situation. In my office there is a large sub-department devoted to the study of the question from the standpoint of subways and cables; another for buildings; another for all telephone apparatus, including central office switchboards; another and very large department working upon the traffic parts of the problem; one devoted to development studies relating to growth of populations and stations and kindred subjects; and still another whose sole duty it is to make fundamental plans based upon all of these data put together and co-ordinated.

These fundamental plans, being based upon all of the factors in the case, provide in outline for the location and number of the underground ducts and cables, the location and size of the central offices, and the size of the central office switchboards.

In the plans which we have made for New York and for other cities in America, it has been found, all things considered, most economical when building new subways to plan for a period of somewhere between 15 and 20 years ahead. These plans are not speculative or paper plans, but we express our confidence in them by following them in the construction which we do each year, putting down not only that which is needed for to-day, but that which, after most careful studies, represents our best judgment of what will be required during a period of 20 years.

It should not be understood, however, that we can forecast with precision the requirements for so long a period ahead, but we have worked with these fundamental plans now for so many years that we know that they form a trustworthy guide, provided that they are continually kept under review and modified each year as the exigencies of growth demand.

I could show to you in many interesting ways the vast sums of money which we have saved because of these fundamental plans, and how absolutely essential they are in enabling us to expend most economically the enormous sums of money which we annually put into our plant. For example, our expenditure for new construction during the first six months of 1910 is more than $21,000,000.

With such plans before us for a given city, we are able to study the probable conditions of the plant at each period of its growth, and with such a guide we are deterred from installing a switchboard or other system, however suitable it might seem to be at the moment, that would not be capable of growing into that form and to that magnitude which would be required of it by the conditions which it must encounter before its life has expired.

Some idea of these conditions at New York, so far as they are affected by magnitude, may be obtained from the following data. The fundamental plans for that city, not including the vast suburban region outside of the municipal limits of Greater New York, provided in 1900 for a system of 51,398 telephone stations, served from 43 central offices, the population of the city being 3,437,000. In 1910 the plans provide for 376,000 stations, served from 52 central offices, with an estimated population of 4,800,000. In 1930 the plans provide for 2,142,000 stations to be served from 109 central offices, with an estimated population of 8,800,000.

Without any commentary whatever these figures at once put us on our guard against the grave danger of assuming, even if the so-called automatic system was suitable for a small number of subscribers, that it would be a proper thing to employ in New York or any other city where it is expected that a proper development of the telephone will take place. This feeling of caution is strengthened when we consider that in the neighbourhood of New York City, there is a vast suburban region intimately connected with it telephonically and served by a very great number of central offices connected by a plexus of trunk lines. But there is more than this which we must take into account when we are studying this automatic system as applied to America. It is the grand ideal of Theodore N. Vail, the founder of the telephone enterprise in America and still its active head, that we shall provide universal service. That is, that each person, firm or company in the United States that ought to have a telephone shall be provided with one, and that any person so provided, wherever he may be located, can within a reasonable time be connected to the telephone of any other subscriber and talk satisfactorily.

This is not a mere dream. We have done solid continuous work upon it for more than 30 years, and now with the rapid strides it is proceeding to fulfilment. At the present time an enormous amount of toll-line business takes place between New York City and the territory tributory to it for 30 miles around. In 90 per cent. of this business the connection is made in an average of 38 seconds, and in the remaining 10 per cent. the average is about 80 seconds. In all of these cases the transmission conditions are so planned that the subscriber may converse with ease. A local call is accomplished in less time, requiring only 22 seconds where but one office is involved, and slightly more between two offices.

These figures which I have given include the elapsed time from the receipt at the central office of the subscriber's signal on the lamp until he is connected with and is talking to the called-for subscriber. But to establish a universal service requires working over much greater distances than this.

We already have an effective long-distance service through underground cables of the Pupin type from New York to Philadelphia (90 miles), and good talking with prompt connections is an every-day matter between New York and Boston (235 miles). Our long-distance wires extend to Chicago and other more distant western cities, and to Washington, Baltimore, Atlanta, and other places in the Far South. At the present time we are extending an underground cable of the Pupin type from New York and Washington (235 miles) and are making surveys and plans for an extension from New York to Boston. More than this, by the adoption of phantom loaded overhead circuits between New York and Chicago, and by similar extensions westward as far as Omaha and thence to the Rocky Mountains, we expect by January 1st next to have so greatly extended our "long-distance" frontier that conversation may be held between Denver, Colorado, and New York City, a distance of 2,200 miles.

I have mentioned these things to give a suggestion of the intricacy and magnitude of the system for which switchboards must be provided, and to bring out strongly the point of view from which we must judge the capabilities of this so-called automatic system. Our problem is national, not parochial—it is indeed even international.

We must provide for the public a comprehensive system of which switchboards form only a part; and which shall be suitable not only for to-day, and for this year and for the next, but which shall be at its best obtainable efficiency during each period of its entire life. These things we must do if we are to avoid stupendous blunders and enormous reconstruction costs.

It is with such thoughts as these that we have studied the question of different types of switchboards in America, and when thus considered, it is surprising to see how many of the features of the so-called automatic systems fail to apply to the conditions of practice. Among these conditions with us is the necessity of providing private branch exchange service. This is done by locating at the subscriber's premises a switchboard provided with trunk lines extending to the central office and with a number of stations, sometimes a very large number, located in different parts of the subscriber's premises and connected with the private branch exchange. Some of these private branch exchanges have as many as 1,200 stations connected with them. This number, however, is exceptional.

By means of this private branch exchange system a most satisfactory method of giving local connections throughout the different parts of the subscriber's premises is provided, and from any of these stations, by means of trunk lines to the central office, connection can be had to any other station in the entire telephone system, whether it be reached by local, suburban or long-distance trunk lines.

Notwithstanding the work that has been done and all the claims that have been made, no practical way has been discovered for doing away with the operators at these private branch exchanges, and the outlook for a practical solution meeting all of the plant, traffic and commercial requirements is so discouraging that at the present time the best opinion is that nothing but failure in this respect is to be expected.

This private branch exchange development forms one of the most satisfactory and important features of the telephone in America. Some idea of its popularity and the magnitude which it has attained, and is expected to attain, will be gathered from the following figures. In 1900 New York City had a total of 1,050 private branch exchange switchboards located at subscribers' premises and serving 12,650 stations connected with them. In 1910 there are 11,960 private branch exchange switchboards, to which there are connected 162,560 stations. In 1930, as a result of our studies of this subject, we are planning for 88,400 private branch exchange switchboards, having connected with them a total of 1,079,000 stations. These figures have a deep significance. They show that in the carrying out of plans upon which construction work is now being done, we shall reach a point where more than half of the stations connected with the New York City system would require to be handled by operators, even if automatic switchboards were installed at the central office. But more operators than these would be required in an automatic system applied to New York. Large numbers of toll operators and of long-distance operators and monitor operators and operators for many other classes of service would be needed.

I have not before me a computation as to the total number which would be required in the system which we are planning, but some years ago a careful study was made with a view to seeing how far the automatic system might be advantageously used in New York City at that time. It was then found that counting private branch exchange operators and the central office operators, the so-called

manual system would require 13,000 operators, and that in the so-called automatic system, leaving out of account the "mechanician operators," there would be required 10,000 operators.

We have studied this automatic system not only in connection with its application to large cities, but also when applied to an entire State. For this purpose a thorough study was made of the telephone system of the State of Connecticut. This study was made by a large staff of most competent engineers, and consumed several months in the making. The result of this was to show that at the time the study was made, if we counted all of the private-branch and other operators needed with the manual system, there was a total of 892 required. A similar careful study showed that if the automatic system were installed 600 operators would be needed, not counting the "mechanician operators."

All these things show that the automatic system, which has so many alluring features about it when its application to simple conditions is considered, becomes more and more unsuitable as the plant grows. Even when the automatic system is applied to the simple case of a single office district, we have yet to find an instance in which the total annual charges lying against it are less than for the manual.

I am aware that statements have been made by the partisans of the automatic system purporting to show that the annual charges on that system are much lower than on the manual. We have analysed the conditions of these cases and found that the comparison was not made upon a fair basis. Where these automatic systems have been installed, they have taken the place of obsolete or inefficient manual systems, and the comparison has been made between an automatic switchboard of the most efficient type known and a manual switchboard of a very defective type. In some cases the comparison has been made between the best type of automatic and the very poorest known type of manual switchboard. It is not surprising, therefore, that from such comparisons, figures could be obtained which would appear to favour the automatic. We have been at great pains and expense to make these comparisons on a proper basis and in a thorough and fair manner.

We have made studies in a number of cities in America, taking into account the factors of operating maintenance, depreciation, taxes, insurance and so forth. In every case we found that the annual charges were in favour of the so-called manual system.

I think enough has been said to show that the automatic system, properly considered, does not do away with operators, does not operate without the constant surveillance of skilled mechanicians, and is in truth not an automatic system at all, but merely one form of semi-automatic system, of which the so-called manual is another.

(*To be concluded.*)

Institution of Electrical Engineers (Birmingham Local Section).

On Wednesday Mr. M. J. Railing, chairman, delivered his inaugural address, taking for his subject the present position of the electrical industries and the means available for improving it. Remarking that all must admit that the position of the industry was not what it ought to be, he said that some blamed our methods of training engineers, others our present fiscal policy, and others, again, the want of enterprise on the part of the leaders. His view was that the conditions had undergone a vast change during the last 50 years, and that the industry had not kept pace with the change. Factors of progress were intuitive genius, on the one hand, and stern necessity on the other, which led to the discovery of new principles and methods and to the solution of the pressing problems arising in practice. Genius could not be bred at will, but the ability to solve problems ought to be especially abundant in this country, with its large number of industries.

Geographical position, early political consolidation and freedom, and the inherent qualities of its people, had helped in the past to make England the trading country of the world, the centre of exchange, whence the English became foremost experts in knowledge of the needs and resources of other countries, and eventually undertook manufacturing on an unprecedented scale. But European countries settled down and began to develop industry and invention; railways and telegraphs diminished the effect of distance, and therefore the geographical advantage of England, bringing the Continental inland countries within easy range of the sea, and the latter soon extended their operations to foreign countries, aided by special export rates, rapidly gaining experience and further decreasing our advantage.

Thus the competing nations, with large and increasing populations, had left us only with the advantages of goodwill, and of common language and descent with our Colonies and sister nations, and if we would progress we must supply manufactures better or cheaper than others.

The advantages of experience and hereditary aptitude in connection with certain industries tended to diminish with time, and the enterprising spirit of the Britisher must be backed by the best possible training.

Our coal had to compete, with cheap water power; our pre-eminence in steel manufacture had left us; copper could no longer be profitably produced in this country; and thus as regarded natural resources and raw materials we had no advantage over other nations. The conditions and hours of labour were less favourable than on the Continent. More efficient organisation of our factories would help us; but for this to be effective it was essential to secure a constant flow of work for production in such quantities as would enable us to make use of our organisation, and to produce on a better and cheaper scale than our rivals. Large output and constant flow of work were a paramount necessity. We could produce everything that could be used in the applications of electricity; industries were waiting for those applications to be brought before them—the great need was the man who could bring the two together. He must know all about the manufacturer and his products, and all about the country or industry where those products were wanted; and he must be able to deal with both parties with knowledge and ability. This country in the past had excelled in the production of such men, and she *would have* to excel in their production again.

Such engineers must be taught and trained efficiently in both manufacturing and the applications of manufactures *in situ*, and in the knowledge of men and their ways, as well as in languages and laws. A generation of commercial engineers, or engineer traders, was needed to give back to us the old geographical predominance, and to enable us to produce in larger quantities, and therefore more cheaply and better.

In this other countries had stolen a march on us. Abroad, commercial universities were springing up, where, in addition to mere commercial knowledge and book-keeping, theory of money and labour exchanges, languages, costing systems, organisation of factories, such wider subjects as social, political and labour questions, railway traffic rates, organisation of credit system, insurance and commercial law, were dealt with. These were subjects of the highest importance, not only to the commercial man, but also to the commercial engineer of the future.

In Birmingham a move had been made in the right direction by the establishment of a commercial faculty at the University, but more was necessary—a free interchange between the engineering and commercial faculties, to enable those trained as engineers to study also commercial subjects. Further, the commercial side of engineering should be considered in connection with apprenticeship, of which a certain portion should be spent in the counting house or the sales branch. The necessary knowledge must be acquired in early life.

LOCALISING PARTIAL EARTH FAULTS IN SUBMARINE CABLES.

By Herbert E. Cann.

Cann's (1896) Triple Test as an Earth Overlap.

As it may be of some little interest to readers of the Electrical Review, and more especially submarine cable electricians, the writer wishes to bring the following facts to their notice. Whilst localising certain "partial earth" faults by Anderson and Kennelly's earth overlap to false zero, these faults, although in some cases not offering a very high resistance, yet were extremely variable, polarisation changes being very rapid, and measurements made to false zero were very difficult to obtain, and in many cases quite unreliable and misleading. The writer therefore determined to take Cann's triple test to true zero. As in Anderson and Kennelly's earth overlap, a resistance was inserted at the short end (station B) so as to bring the fault electrically in the centre of the cable. Each station earthed and tested alternately for three-minute periods, and balances were obtained and the inserted resistance varied until both stations arrived at the same result, or a very near approximation, *i.e.*, when the resistances A, B and C, obtained at either end, were reduced by the formula A + B − C, the calculated resistance was the same on both sides of the fault.

A = resistance obtained with highest current.
B = resistance obtained with intermediate current.
C = resistance obtained with lowest current.

When the calculated resistances on both sides are equal, x then becomes by formula—

$$\frac{L - R}{2}$$

where L = C.R. of line when perfect.
where R = inserted resistance (on short end).

The batteries employed were in the ratio of 4, 2, 1, and the E.M.F. was purposely kept low, as it was found that anything approaching 20 m.a. and upwards had a tendency to develop gas at the fault, rendering the balances far more difficult to obtain, and therefore more unreliable. Much steadier results were obtained with a moderate voltage. The E.M.F. and bridge ratios were the same at both stations. The writer is without any information as to whether this combination test has been employed up to date, but in Wilkinson's "Cable Laying and Repairing," new edition, one finds the remark "If the false zero is very unsteady or the readings variable, the balances may be taken to true

zero, eliminating the earth current effect by Mance's method." However, as any information concerning new tests or modifications of well-known fault tests is always welcomed by the cable fraternity, it is superfluous to enlarge on the subject. It is sufficient to remark that this combination of Cann's and Anderson and Kennelly's earth overlap has invariably given good reliable results.

Two examples of cable faults localised by this method are given below :—

EXAMPLE I.

C.R. of line (L) when perfect = 3,270ω { Resistance of line and fault measured from A station with 20 cells—end "free" at B station = 6,000—7,000ω variable.

Three bridge balances (from both ends) to true zero with 20, 10 and 5 cells, 30, 15 and 7·5 volts approximately. Both stations using same E.M.F. and bridge ratios 1,000 : 1,000.

1st test.—Without inserted resistance :

B station earths and A station obtains balance with—

20 cells = 3,045 A
10 cells = 3,069 B
5 cells = 3,100 C
} then A + B − C = 3,014ω.

A station earths and B station obtains balance with—

20 cells = 2,695 A
10 cells = 2,775 B
5 cells = 2,815 C
} = 2,655.

2nd operation.—B, being the short end, now inserts 700ω :

A station tests (B earths).		B station tests (A earths).	
A = 3,500		A = 3,380	
B = 3,540	= 3,452ω	B = 3,480	= 3,320ω
C = 3,588		C = 3,540	

3rd operation.—B station now inserts 200ω more (total inserted resistance, 900ω) :

A station tests (B earths).		B station tests (A earths).	
A = 3,570		A = 3,620	
B = 3,640	= 3,493ω	B = 3,690	= 3,570ω
C = 3,717		C = 3,744	

NOTE.—As B's results are now 77ω higher than A's, it shows that too much resistance has been added at B ; B therefore reduces his inserted resistance by 80ω.

4th operation.—B station now reduces his inserted resistance to 820ω :

A station tests (B earths).		B station tests (A earths).	
A = 3,540		A = 3,540	
B = 3,630	= 3,510ω	B = 3,625	= 3,495ω
C = 3,660		C = 3,670	

5th operation.—B station now increases his inserted resistance to 830ω :

A station tests (B earths).		B station tests (A earths).	
A = 3,535		A = 3,523	
B = 3,625	= 3,500ω	B = 3,630	= 3,498ω
C = 3,660		C = 3,655	

6th operation.—Check test with 835ω inserted at B station :

A station tests (B earths).		B station tests (A earths).	
A = 3,380		A = 3,400	
B = 3,460	= 3,300ω	B = 3,470	= 3,315ω
C = 3,540		C = 3,555	

NOTE.—From the difference in the resistance obtained in the last two tests, it will be seen that the resistance of the fault was changing rapidly. The values calculated from the balances obtained at A and B stations during the 5th operation being almost identical—viz., 3,500ω and 3,498ω—proved that the inserted resistance was about correct.

This being so, then the distance to fault from B station (short end) becomes

$$x = \frac{L - R}{2} = \frac{3,270 - 830}{2} = \frac{2,440}{2} = 1,220\omega.$$

L = C.R. of cable when perfect.
R = Inserted (added) resistance at short end.

If we take the mean of the results obtained during the 4th, 5th and 6th operations, then x becomes—

4th operation = $\frac{3,270 - 820}{2} = \frac{2,450}{2} = 1,225\omega$
5th " = $\frac{3,270 - 830}{2} = \frac{2,440}{2} = 1,220\omega$
6th " = $\frac{3,270 - 835}{2} = \frac{2,435}{2} = 1,217{\cdot}5\omega$
} Mean = 1,220·8ω ; say, 1,221ω

True distance to fault in ohms from B station = 1,220.

EXAMPLE II.

Total C.R. of line (L) when perfect = 4,424ω.

Preliminary test.

A station tests with 20 cells (30 volts). with end free at B ... ... } Resistance = 14,000ω
B station tests with 20 cells (30 volts). with end free at A ... ... } " = 10,600ω

Overlap test now taken with 20, 10 and 5 cells (30, 15 and 7½ volts), and equal ratios 1,000 : 1,000 at each station ; each station testing and *earthing* alternately.

NOTE.—As a full explanation was given in Example I, only bare figures will be given in following examples :—

1st.—No resistance inserted at either station :

A station's balances.		B station's balances.	
A = 4,050		A = 3,780	
B = 4,110	= 4,040ω	B = 3,880	= 3,750ω
C = 4,120		C = 3,910	

2nd.—B station now inserts 600ω :

A station.		B station.	
A = 4,420		A = 4,370	
B = 4,550	= 4,365ω	B = 4,505	= 4,305ω
C = 4,605		C = 4,570	

3rd.—B station, being still too low, inserts an additional 100ω : total, 700ω :

A station.		B station.	
A = 4,460		A = 4,460	
B = 4,590	= 4,407ω	B = 4,580	= 4,380ω
C = 4,643		C = 4,660	

4th.—B station being still too low, 725ω are inserted :

A station.		B station.	
A = 4,514		A = 4,526	
B = 4,647	= 4,441ω	B = 4,680	= 4,466ω
C = 4,720		C = 4,740	

5th.—B station, being now too high, reduces inserted resistance to 710ω :

A station.		B station.	
A = 4,505		A = 4,510	
B = 4,644	= 4,435ω	B = 4,650	= 4,440ω
C = 4,714		C = 4,720	

6th.—B now inserts 700ω :

A station.		B station.	
A = 4,520		A = 4,510	
B = 4,642	= 4,442ω	B = 4,670	= 4,456ω
C = 4,720		C = 4,730	

**7th.*—B now reduces to 685ω :

A station.		B station.	
= 4,480		A = 4,480	
B = 4,640	= 4,406ω	B = 4,650	= 4,410ω
C = 4,714		C = 4,720	

**8th.*—B reduces further to 675ω :

A station.		B station.	
= 4,484		A = 4,480	
B = 4,634	= 4,408ω	B = 4,630	= 4,405ω
C = 4,710		C = 4,705	

**9th.*—B station, having now the lower resistance, increases inserted resistance to 680 :

A station.		B station.	
A = 4,478		A = 4,470	
B = 4,636	= 4,399ω	B = 4,640	= 4,395ω
C = 4,715		C = 4,712	

* These results being only 4, 3 and 1 units respectively out of equality, the mean was taken. Then $x = \frac{L - R}{2}$.

7th = $\frac{4,424 - 685}{2} = \frac{3,739}{2} = 1,869{\cdot}5\omega$ from B station.
8th = $\frac{4,424 - 675}{2} = \frac{3,749}{2} = 1,874{\cdot}5\omega$ from B station.
9th = $\frac{4,424 - 680}{2} = \frac{3,744}{2} = 1,872{\cdot}0\omega$ from B station.

3)5,616·0ω
1,872·0ω mean.

True distance to fault = 1,874 ohms.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

AUSTRALIAN COMMONWEALTH.—The following decisions have been given by the Australian Customs authorities :—

Asphaltum, being a refined mineral pitch ... ... Free.
Electrical appliances, &c.—
Brushes, carbon, for dynamo-electric machines ... ... 20 %
Brushes for dynamos over 200 B.H.P. are suitable for use on dynamos under 200 B.H.P.
Cells, electric, Bleeck-Love ... ... 10 %
These are primary batteries. The parts manufactured in the United Kingdom are of the greater value, and the cells may be admitted at the preferential rate.
Conduit, electric, Key-spring.—This is electric metal conduit piping in half-sections, one section fitting over the other, and metal fixings :
Casing (tubing in half-sections) ... ... Free.

Tool, wire, for fixing the casing together or taking it apart	25 %
Brackets	25 %
Clips, spring, for clipping to the brackets	25 %
Bends and tees in half-sections	Free.
Bonds	25 %
Capping	Free.

"Fuse box" and "enclosed fuse."—An "enclosed fuse" is an article having a porcelain base with two terminals for the fuse wire, and two porcelain bushes, enclosed in a box, or cover of iron or other material. A combination of two such "enclosed fuses" mounted on a board provided with four insulators is known as a fuse board or distributing board, as the case may be. If, however, instead of the plain board (which may be of marble, slate or wood), a cover and sides were added, the whole (*i.e.*, the two "enclosed fuses" described) would be known as a "fuse box." In other words, the distinction to be drawn amounts to whether the fuses are mounted on a board of any description, or *separately* enclosed each in its own case. If several separate fuses were enclosed in an iron case, such a combination would be known as a "fuse box."

Insulators, lead-in. (Metal tubular head with a porcelain tube cemented into and through it.)	25 %
Lamps, &c.—Arc lamp, "Gral metallic"	10 %

The light is obtained by heating a metallic wire to incandescence in vacuo. In outward appearance it is similar to an ordinary arc lamp.

Gallery, shade, being an attachment for an electric lamp to hold the globe	15 %
Recording device, "Eco," for checking watchmen. Clock regulator No. 1 combined with electric recorder. (The recording device alone is an electric appliance, but it is understood it is always accompanied by a clock.) ...	Free.

ARGENTINA.—The Argentina *Boletin Oficiel* of September 20th contains a revised list of the materials and articles which may be imported into the Republic free of duty by such electric railway and tramway companies as are by law entitled to the privilege for the construction and working of their lines. The same *Boletin* also contains amended regulations respecting the administrative control of the uses to which such articles and materials are put. A copy of the *Boletin* may be seen at the offices of the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

25,224. "Improvements in current graduating devices or resistances, especially applicable for electric lighting," W. SUMNER. October 31st.

25,242. "Improvements in or relating to dry galvanic cells." F. WEATHERILL. October 21st.

25,243. "Improvements in or relating to automatic telephone systems." W. WANISCH. October 31st. (Complete.)

25,280. "Improvements in receiving apparatus for wireless telegraphy." R. R. GOLDTHORP. (Date applied for under Sec. 91 of the Act, October 29th, 1909, being date of application in the United States.) October 31st. (Complete.)

25,304. "Improved method and apparatus for the wireless control of airships and other craft and mechanisms." J. A. CORRY. October 31st.

25,315. "Improvements in or relating to galvanic batteries." W. MORRISON. (Date applied for under Sec. 91 of the Act, November 22nd 1909, being date of application in United States.) October 31st. (Complete.)

25,348. "Improvements in or relating to secondary batteries." W. S. NAYLOR. November 1st.

25,363. "Improvements relating to high-tension switchboards." J. HALL. November 1st.

25,368. "Improvements in electric annunciating apparatus." H. J. ALTHER and G. W. GILL. November 1st. (Complete.)

25,369. "Improvements in section insulators for overhead wires and cables of tramway, railway and like systems." S. W. MITCHELL (trading as Player and Mitchell and H. McP. Dudgeon). November 1st. (Complete.)

25,371. "Method of and the means for the electric lighting of pictures, works of art and the like." S. W. MADDICK. November 1st.

25,385. "Improved process and apparatus for the rectification of alternating electric currents." J. J. MONTGOMERY. November 1st. (Complete.)

25,397. "Improvements in and relating to the excitation of induction dynamo-electric machinery." AKT. GES. BROWN, BOVERI ET CIE. (Date applied for under Sec. 91 of the Act, November 1st, 1909, being date of application in Germany.) November 1st. (Complete.)

25,401. "Improvements in the treatment of ores, particularly the ores of tungsten and like metal." C. M. JOHNSON. (Date applied for under Sec. 91 of the Act, January 31st, 1910, being date of application in United States.) November 1st. (Complete.)

25,404. "Improvements in and relating to electric lamps and reflectors for the same." D. J. O'BRIEN and R. M. CATTS. November 1st.

25,411. "Improvements in and relating to the manufacture of tungsten wires, filaments and the like." J. GRAY. (K. Schwab, Germany.) November 1st. (Complete.)

25,426. "Automatic electric control of the traversing motion of electric coal-cutting machines." T. W. CROSSLAND and A. CROSSLAND. November 2nd.

25,449. "Switch for controlling electric fog signals." J. W. BRETTEL. November 2nd.

25,478. "Improvements in and relating to ceiling roses and like electrical fittings." E. I. PARKES. November 2nd.

25,502. "Improvements in telephone switchboards." W. AITKEN and BRITISH INSULATED AND HELSBY CABLES, LTD. November 3rd. (Complete.)

25,516. "Improvements in or relating to the packing of plates of electric storage batteries." B. M. DRAKE, J. WADDELL and D.P. BATTERY Co., LTD. November 3rd.

25,528. "Improvements relating to apparatus for recording telephone messages." A. E. LAMKIN and L. G. GODWIN. November 3rd.

25,539. "Spark plug isolations." A. HERZ. (Date applied for under Sec. 91 of the Act, November 9th, 1909, being date of application in Austria.) November 3rd. (Complete.)

25,563. "Improvements in electric telegraphy." A. MUIRHEAD and MUIRHEAD & Co. November 3rd.

25,564. "Improvements relating to warning devices for use in electric circuits." H. LUCAS and B. V. O'CARROLL. November 3rd.

25,565. "Improvements relating to electric lighting systems for motor vehicles." H. LUCAS and B. C. O'CARROLL. November 3rd.

25,566. "Improvements relating to electrical ignition devices." F. B. LODGE and A. LODGE (trading as Lodge Bros. & Co.). November 3rd.

25,588. "Improvements in and relating to self-regulating dynamo-electric machines." C. A. VANDERVELL and A. H. MIDGLEY. November 3rd.

25,607. "Improvements in time mechanism for operating electric switches, gas valves and the like." F. T. REID. November 4th.

25,622. "Improvements in tacheometric telescopes." C. ZEISS. (Date applied for under Sec. 91 of the Act, November 10th, 1909, being date of application in Germany.) November 4th. (Complete.)

25,634. "Improvements in or relating to self-regulating arc lamps for projection." A. SCHMIDT. November 4th.

25,670. "Improvements in Röntgen ray and like electro-medical photographic apparatus." H. F. BIGGE and F. R. BUTT. November 4th. (Complete.)

25,678. "Improvements in and connected with dynamo-electric generators." G. FULLER and B. J. MOORE. November 4th.

25,679. "Improvements in and connected with portable electric hand lamps." G. FULLER, G. J. A. FULLER and L. FULLER. November 4th.

25,683. "Improvements in variable-speed alternating-current induction motors." BRITISH THOMSON-HOUSTON Co., LTD., and J. MARTIN. November 4th.

25,700. "Improvements in the enumeration of telephone calls." S. D. WILLIAMS. November 5th.

25,715. "Improved means of fixing lamp shades or reflectors or incandescent electric lampholders, and an appliance for expeditiously removing or replacing same." R. W. TOWNLEY. November 5th.

25,725. "Improvements in the manufacture of telephone or telegraph conductors or cables." D. BATES, C. W. BEARD, A. H. SCHULTZ, F. J. BRISLEE, D. B. SAUNDERSON, and BRITISH INSULATED & HELSBY CABLES, LTD. November 5th.

25,726. "Improvements in the manufacture of telephone or telegraph conductors or cables." Particulars same as 25,725.

25,782. "Improvements in electrical current transformers." SIEMENS BROS. AND Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) November 5th.

25,756. "Improvements in electric switches." M. D. SCOTT. November 5th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

CIRCUITING ARRANGEMENT FOR WORKING MONO AND POLYPHASE ALTERNATING CURRENT MOTORS. A. Heyland. 22,932. October 7th. (Date applied for under International Convention, October 10th, 1908.)

CHAINS FOR SUSPENDING ELECTRIC PENDANTS, ELECTRIC CHANDELIERS, AND THE LIKE. R. J. Simpson. 22,988. October 8th.

ELECTRIC ARC LAMPS. R. Neu. 23,014. October 8th.

GAS CONTROLLERS, ELECTRIC TIME-SWITCHES, AND OTHER TIMING DEVICES. G. O. Horstmann, E. H. Horstmann, A. Horstmann, S. A. Horstmann and W. T. Edgar. 23,161. October 11th.

MANUFACTURE OF ELECTRICAL RESISTANCES. A. W. Maley. 23,216. October 11th.

CONTROL OF ELECTRIC MOTORS. H. C. Leake. 23,217. October 12th.

WINDINGS FOR ALTERNATING-CURRENT MOTORS. M. Stern. 23,553. October 14th. (Date applied for under International Convention, October 31st, 1908. Request under Sec. 19 of the Act not granted.)

DYNAMO-ELECTRIC MACHINES. H. Lippelt. 23,756. October 16th. (Date applied for under International Convention, October 16th, 1908.)

PORTABLE ELECTRIC LAMPS. G. N. Vitanoff. 23,808. October 18th.

APPARATUS FOR COOKING OR FOR HEATING AIR AND OTHER MEDIA BY MEANS OF ELECTRICITY. C. G. Bell and J. St. V. Pletts. 23,818. October 18th.

APPARATUS FOR COOKING AND LIKE OPERATIONS BY MEANS OF ELECTRICITY. C. G. Bell and J. St. V. Pletts. 23,819. October 18th.

MEANS FOR SUPPORTING ELECTRIC LAMPS. H. S. Harrison. 23,980. October 19th.

APPARATUS FOR CONTROLLING ELECTRIC MOTORS. H. E. Day. 24,203. October 21st.

POWER PLANTS EMBODYING ALTERNATING-CURRENT GENERATORS AND MOTORS. H. A. Mavor and Mavor & Coulson, Ltd. 27,478. November 25th.

AUTOMATIC ELECTRIC FLASHLIGHT DEVICE. H. F. Reason and Reason Manufacturing Co. £0,000. December 22nd.

1910.

ELECTRIC SWITCHES. B. Brooks and F. H. Alston. 800. January 12th.

ARRANGEMENTS FOR TRANSMITTING POWER BY MEANS OF POLYPHASE ALTERNATING ELECTRIC CURRENTS. Siemens-Schuckertwerke Ges. 3,117. February 8th. (Date applied for under International Convention, February 27th, 1909.)

ELECTRIC LIFTS AND OTHER LIFTS, AND LIKE APPARATUS. D. E. Barnes and A. A. G. Jensen. 4,713. February 25th.

APPARATUS FOR STRENGTHENING WEAK ELECTRICAL IMPULSES, PARTICULARLY APPLICABLE FOR USE IN WIRELESS TELEGRAPHY. W. P. Thompson. (Ges. für Drahtlose Telegraphie.) 10,210. April 26th.

SANITARY MOUTHPIECES FOR TELEPHONES AND OTHER INSTRUMENTS. J. B. O'Hara. 15,448. June 28th.

APPARATUS FOR PRODUCING ELECTRICAL-IMPULSE CHARGES FOR WIRELESS TELEGRAPHY AND TELEPHONY. S. Eisenstein. 16,856. July 8th. (Application for Patent of Addition to No. 10,019 of 1908.)

PROCESS FOR PACKING FOR TRANSPORT CHARGED NEGATIVE ELECTRODES OF ACCUMULATORS. Accumulateurs Tudor Soc. Anon. 18,398. August 3rd. (Date applied for under International Convention, August 5th, 1909.)